POPULAR Computing WEEKLY

MICRODRIVE REVIEW

35p 28 July-3 August 1983 Vol 2 No 30

This Week

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Dragon software
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J Coote comes out of his shell to provide a simple introduction to turtle graphics and its uses See page 18

Micro pop
David Kelly talks to Pete Shelley about his new LP XL1 which includes a computer program for the Spectrum See page 13

★STAR GAME★
Money Snake on Vic20.
See page 10.

News Desk

Sold out before it's started

COLECO's new Adam computer is already sold out — before a single unit has been manufactured.

The company says it has commitments from American retailers to buy all 500,000 units it plans to make this year.

The Adam was the star of the Chicago Consumer Electronics Show held in June (see *Popular Computing Weekly* June 23). The computer appears to offer outstanding value for money — an 80K machine incorporating full keyboard, twin high-speed tape storage devices and daisy wheel printer — all for around $600 (£400). US industry experts report that the Adam will create a new market by providing a complete system at a mass market price. Production of the Adam is geared to begin in August.

The Adam is expected to make its debut in this country sometime in October or

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Bilbo and Horace go walkabout

MELBOURNE House has almost finished work on versions of some of its games to run on machines other than the Spectrum.

The Hobbit will go on to the 48K Oric, BBC and Commodore 64 machines, available in mid-September. Each will cost the same as the Spectrum version — £14.95 — and come complete with a copy of J R R Tolkien's book *The Hobbit* and an instruction manual.

The programs themselves will be exactly the same as the Spectrum one except that where possible — on the BBC for example — the graphics will be enhanced.

Also the company will re-

Continued on page 5

Continued on page 40

★ ★ MICRODRIVE REVEALED — SEE PAGE 8 ★ ★

Dare YOU enlist as a Free-System warrior?

My creators are Cable Software and their new game "DRONE Datatank" *has been reviewed as "the roughest, toughest arcade game to hit the Dragon scene to date"*

Dare YOU *enlist in attempting to destroy the evil "Rom Guardian" who will be protected by his army of "Drones", "Bugs" and "Bytes" determined to protect their Master at all cost*

Will you be able to manoeuvre your Datatank through the Grid Zones and Memory Tunnels whilst fighting off the enemy attacks and avoiding the many perils you will encounter

Dragon Owners prepared to volunteer for active duty in my task force will receive my pre-recorded training message to help them succeed, but because of the many dangers involved, only the courageous should apply to enlist for this difficult mission

If you think that you are brave and skilful enough for this task, write **to our Headquarters Address below** *Give details of your name and address enclose a cheque/P O for* **£8 75** *and by return you will receive all you need to begin, including a Program and Training Cassette, a "Top Secret" Datatank Instruction Manual and a Keyboard Overlay (used to prepare your computer for action)*

If you join me in this valiant crusade, GOOD LUCK in your efforts. **NOW AVAILABLE AT BOOTS AND JOHN MENZIES**

T R O F F (Training Robot Officer of the Free-System Federation)



Dragon Software Retailers keen to recruit volunteer "Drone" fighters into their own Battalion can contact us for details of our trade terms If you decide to phone us our scrambler is operational 24 hours so don't worry about bugging we are permanently on battle alert

Any programmers who wish to join us in ensuring that the best programs will always be available by "Cable" should contact us with details of any original programs written and will hear about the attractive prospects we can offer for marketing any program good enough to meet our very high standards

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cable software

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GRAPHIC PLANNING PADS (100 Sheets A3 — 11¾" x 16½") The large size sheet allows the incorporation of an enlarged high resolution grid with the pixel coordinates numbered on all four axis to allow easier visual planning when programming graphics Structured reference sections are clearly defined to enable all relevant information to be detailed on the same sheet making it simple to refer to if problems are encountered when running the program Pads are available for Spectrum, Dragon 32 and BBC

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Articles which are submitted for publication should not be more than 3 000 words long The articles and any accompanying programs should be original It is breaking the law of copyright to copy programs out of other magazines and submit them here — so please do not be tempted

All submissions should be typed and a double space should be left between each line Please leave wide margins

Programs should whenever possible be computer printed

We cannot guarantee to return every submitted article or program so please keep a copy If you want to have your program returned you must include a stamped addressed envelope.

Accuracy
Popular Computing Weekly cannot accept any responsibility for any errors in programs we publish, although we will always try our best to make sure programs work

This Week

Editorial

Humour is not a subject immediately associated with microcomputers Most people tend to regard micros as either serious technological tools or as games playing machines — fun, but not funny

Programmers, however often possess an anarchic sense of humour The best programs usually contain some element of the programmer s personality, which is often manifested in a humorous response to an unlikely input Adventure players, for example who try to break into a listing, are often surprised to be told they are cheating

Another example can be seen in the film *2001* The name of the computer *HAL*, is actually a subtle dig at a giant US computer company If you move each letter of the name *HAL* along one in the alphabet, you will discover that *H* is immediately followed by *I*, *A* by *B* and *L* by *M* — *IBM*

With the next generation of micros likely to contain their own personalities, the subject of humour becomes more important It should not be too difficult to program a micro to imitate the sense of humour of its programmer But, will it ever be possible for a micro to appreciate a joke, or generate one of its own?

A micro possessed of artificial intelligence, but devoid of humour, would be incomplete A sense of humour will in a very real sense humanise a micro

Next Thursday

Try and get home along the path, but stray off it and the man-eating crocodiles will get you and you ll lose one of your 12 lives Martian Maze for the Dragon 32 by Kevin Whitley

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Bilbo and Horace

Continued from page 1

lease the Horace series of programs — *Hungry Horace*, *Horace Goes Skiing* and *Horace and the Spiders* for the Vic20, Commodore 64 and Dragon machines. These should be available during August and September.

Sold out Adam

Continued from page 1

November. According to CBS Electronics' Alan Abrahams, though, only a few thousand machines will arrive at first — a direct result of the number of orders which have to be fulfilled in the US.

Notwithstanding, the UK company has already received more than 4,000 orders for the Adam.

CBS agrees to tie-up with Quicksilva

CBS Records has agreed to distribute Quicksilva's software.

Under the deal, CBS will become the sole UK manufacturer of Quicksilva's cassette software range and also their exclusive UK distributors.

"We will market their product in the same way as our current audio and video material," said CBS Records' Ashley Gray.

"For example, we act as manufacturers and distributors for A&M and DJM in the records field and CIC and MGM in the video field.

CBS is looking to build up about five labels for the software side. "We have two now — our own Coleco and Quicksilva — and we are pursuing two other deals at the moment," said Ashley. "Our aim is to end up with four out of the top six independent non-manufacturer-aligned houses."

● In a separate deal, Quicksilva's move into the US (see *Popular Computing Weekly*, July 21) is a joint venture with the American CBS parent. Quicksilva is now looking to distribute software from UK houses in the States through its new subsidiary. According to Quicksilva UK's managing director, Rod Cousins, the company is currently talking to a number of British houses including Salamander, Anirog and Bug Byte. Quicksilva is also exploring the possibility of producing material through CBS for Coleco's new Z80-based Adam computer.

US printer comes over

ALPHACOM 32 is a new printer for the ZX Spectrum.

The machine is very similar to the Timex Sinclair 20 40 printer sold in the US – it is manufactured by the same company.

Like Sinclair's more familiar UK model, the ZX printer, the Alphacom 32 uses aluminised paper for printing but it is slightly wider – 4½ inches.

Available from Dean Electronics, Glendale Park, Fernbank Road, Ascot, the Alphacom 32 is priced at £99.95.

Helping police with enquiries

A SUBSTANTIAL proportion of the 3,000 Sinclair Spectrums stolen from distributors Prism Microproducts four weeks ago have now been recovered.

The missing Spectrums, stolen on June 26 (see *Popular Computing Weekly*, July 7), were traced after machines were offered to some shops usually supplied by Prism. Commented Prism's Graham Daubney: "Once the news was broken that the theft had taken place, shops became very wary about being offered Spectrums."

A number of people are now helping police with their enquiries.

Sord slashes prices

THE price of the Sord M5 home computer has been cut by £40.

The new price of £149.95 became effective from Monday, July 25.

Existing owners of the M5 who bought the machine at the higher price will all be offered the £35 M5 *Basic G* graphics cartridge free.

Developing Oric

AWA software has produced a new machine code development tool for the 48K Oric.

Orion is a two pass assembler/full 6502 disassembler/single-step monitor. The program displays the contents of the CPU registers, the addresses of the next two instructions, the state of the flags and the mnemonics of the next two instructions. Thirteen commands are available directly from the monitor including number conversion, move memory, fill memory, string search and set breakpoint.

Orion retails at £12.95 and comes complete with a 24-page manual. More information from AWA Software, 50 Dundonald Road, Didsbury, Manchester.

BBC understands two more languages

HCCS Associates has expanded the range of languages the BBC microcomputer can understand.

Tiny Pascal and Log Forth are the two new packages available on 16K Eproms, price £67.85 each.

More details from HCCS Associations, 533 Durham Road, Gateshead, Tyne and Wear.

Essex Beagle wins Sinclair marathon

THE second annual Sinclair Cambridge Festival Half Marathon — held last Sunday — has been won by Essex Beagles runner Bob Treadwell with a time of 1hr 4mins 36secs.

His time is 41secs faster than that of last year's winner, marathon record-holder Ian Thompson.

Run under heat-wave conditions, the start of the competition was returned to begin at 7.30 in the morning, before temperatures began to soar. The 1,400 competitors included a strong contingent from the race's sponsors, Sinclair Research. Among the brave six were Sir Clive himself and managing director Nigel Searle.

Despite Sir Clive's time of 1hr 47mins 43secs, almost four minutes better than his performance last year, he was beaten for the first time by one of his own company's runners. Finance director Bill Matthews recorded a time of 1hr 30mins 41secs. Sir Clive finished 949th.

Atari range trimmed

ATARI will not be bringing all of its new family of computers over to the UK.

Only the 600XL, 800XL and 1450XL are scheduled to come over — the 1200XL and 1400XL will remain at home.

The 600XL and 800XL are natural successors for the existing 400 and 800 machines and will sell for around £150 and £250 respectively. They are both expected this year.

The 1450XL is more of a business system with built in disc drives and is expected to be priced around £500. This machine is not expected in the UK until early 1984.

Guarantee system

We Abbex The Games People were extremely pleased to see the letter from David M Webb in your issue of 7-13 July on Copy-cat programs. We are in wholehearted agreement with the sentiments expressed and we would like to assure all our customers that we have for some months now operated a guarantee system on program tapes such as they suggested.

All of our tapes are sold with a guarantee card enclosed. If the tapes get damaged at any time, we will immediately provide a replacement copy upon the receipt of the damaged original, the guarantee card and 50p to cover p&p.

May we take this opportunity to congratulate you on an excellent magazine and inform all Turtle Lovers that our address has recently changed, following the merger of our London and Bedford offices, to larger premises in Bedford. However, don't worry if you have recently sent an order to the old London address because all mail will be forwarded.

Happy Turtle Hunting!

The Turtle
Abbex the Games People
Tavistock House
34-36 Bromham Road
Bedford MK40 2QD

Glad to see that David Webb's suggestion about replacing damaged cassettes has already been taken up — GOSH please note.

As for the Turtle (wearing roller-skates yet), which company do you think has the best/worst logo and why?

Lost program!

In *Peek and Poke* (*PCW*, Vol 2 No 26) Ian Beardsmore tells D Moore of Cleveland that

```
POKE 23636 0
POKE 23635+1 0
```

will achieve a line zero in your Spectrum Basic program. If any of your readers tried his advice, and are currently mourning their lost program, they might like to know that they can recover their missing handiwork by

```
POKE 23636,203 POKE 23638 92
```

Now, to answer D Moore of Cleveland, I think what Ian meant was to try something like this

```
1 REM Title of the program
2 POKE ((PEEK 23635+256*PEEK 23636)+1) 0
RUN
LIST
```

after which you will find that the Rem statement that was line 1 is now line 0. But it is not editable, without resetting the line number back to 1.

Slightly less pedantic programmers than myself might find the following simpler

```
1 REM Title of program
2 POKE 23756 0
RUN
LIST
```

A little light is shed on the matter in the Spectrum manual on page 166 (format of a Basic statement), and page 176, which tells you how to inspect the first 22 bytes of the program area.

Bob Hardman
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Hants SO5 9DB

The last word

I would like to submit a conclusion to the case of the Spectrum versus Dragon. The main criterion for purchasing microcomputers must be available resources. For the £200 and under price range the Dragon offers to users great power and speed, all of which is spoiled by its ugly case and poor screen display capabilities, ie, black on green upper case text that is immiscible with its hi-res graphics. There are machines immune from these disorders, namely the Atari 400, the TI 99/4A, the BBC micro and, in my opinion, the Spectrum.

Mettoy are to market the Dragon abroad. I would suggest to them that before exporting they ought to improve the product. *Then* they would, at last, have a popular machine on the market.

On July 4, I received a letter from some irate Dragon fanatics. It was unsigned and devoid of address. From their few words that had somehow been strung together, I found that they had many misconceptions about the Spectrum. Here are three of their numerous claims: the Dragon has more Rom than the Spectrum — untrue, there is no way of getting orange on the Spectrum — untrue (see manual pp124-5), I am a wally — untrue.

The only wally is my friend Mike 'Pacman' Smith. You may remember he spent three paragraphs explaining the virtues of the Dragon before revealing that he was so impressed with his machine that he sold it and bought an Oric!

Andrew Wiseman
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And that is definitely the last word on the subject.

Always illegal

While it can be legal to copy tapes (*PCW* 30 June — 6 July), the copying of any copyright material (whether from print, tape, disc, video tape or whatever) without permission (express or implied) is always illegal.

The selling on of such stolen copyright material is despicable. But it can only happen if people are prepared to *buy* it!

It is in our power to kill the practice.

Paul Holgate
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An ideal machine

For nearly as long as I can remember in my computing life, people have been asking how long the ZX81 will be in demand. I think it was about a year ago that I read a letter in a magazine stating that all the possibilities of the ZX81 had been exhausted. On that occasion I wrote to the editor concerned strongly contesting that view. It is almost as if some people are *willing* the end of the great little micro.

In your editorial (*PCW 7-13 July*) you speak of the 'extra £50' involved in buying the Spectrum as if it were mere chicken-feed. In fact, to many people £50 is a great deal more than chicken-feed, and may well make the difference as to the practicability of buying a micro at all. For instance, there are millions of young people on the dole who have very little money to burn, and yet may decide to buy a ZX81 in order to learn computing or to practice what they learned at school.

Not everyone has a colour television available for use as a computer monitor, in which case the advantages of the Spectrum over the ZX81 are severely reduced. With the advent of hi-resolution software for the ZX81, if you forget about colour, then there is not a great deal that the Spectrum can do that the smaller micro cannot. For those interested in machine code programming, there is good reason to think that the ZX81 is in many respects *better* than the Spectrum, since its Ram is easier to manipulate.

One big problem that merits some attention is the preoccupation with games. A survey some time ago held that while 90 percent of micro owners originally bought them for some application other than games, six months later 90 per cent of these were now using their micros almost exclusively for games. A recent report in Time Magazine referred to complaints that, without expensive add-ons, some micros are little more than games machines.

What is needed now is not an ever increasing variety and complexity of micros, but a change of direction in terms of their application. People need to be encouraged not merely to buy commercial software or to copy games blindly from the pages of magazines, but to actually write their own software, tailor-made for their own requirements. For this purpose, the ZX81 remains an ideal training machine.

The general public is susceptible to the promise of 'bigger is better', but I feel that people are actually being cheated because the additional features, for all their cleverness, do not actually give any extra benefits that are of any practical use. If all you want to do is zap aliens, then I suppose that the colour and glitter of the bigger machines is attractive, but if you are genuinely interested in *computing*, then in terms of value for money there is no better machine than the ZX81.

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EXCLUSIVE

***Bill Hoskins** presents the first review of the Sinclair ZX Microdrive and interface*

The Sinclair Microdrives are here! At last! These long awaited devices have finally appeared on the market over a year after the first prototype was shown at the Spectrum launch in April 1982

After many false rumours about mini discs and credit card type media the Microdrive turns out to be after all a very fast continuous tape loop system The Microdrive does not work on its own however — it requires a special interface

The ZX interface 1 previously known as the expansion module, is a wedge-shaped box that plugs into the back of the Spectrum, and sits underneath it tilting the keyboard up at about 20 degrees It is actually screwed on to the Spectrum to prevent any wobble, such as that of the infamous ZX81 Ram packs This design can cause problems for users (like myself) who have their Spectrums in other cases, but is ideal for the majority who do not.

The interface adds three features to the Spectrum — a Microdrive controller, an RS232 interface, and networking capability It does all of this using existing Basic statements

The electronics inside the interface contain the extra routines to control the peripherals in an additional 8K Rom as well as circuitry to convert between serial and parallel for the Microdrives and to convert the RS232 voltage levels Hardware add on companies will be relieved to know that only the address lines stated in the original manual are used so most accessories should be compatible However it may be incompatible with the forthcoming Rom cartridge adapter and the Timex version of the Spectrum

Each Microdrive is about 8 × 9 × 5 cm in size, and looks similar to the original Spectrum advertisements with the famous coming soon title Up to eight Microdrives can be connected at one time with the first one connected to the left-hand side of the interface via a short cable — subsequent Microdrives connect into the side of the first

The Microdrives use tiny cartridges about 30 × 43 × 5 mm in size that contain the 16ft of very narrow tape that the data is stored on An LED indicator shows when the drive is in action No cartridge should be in a drive either when the power is first applied or when it is disconnected, else damage may result

The demonstration cartridge to be included with each Microdrive has several programs on it The first is called "Run" and automatically *Loads* and Runs when you type Run after switching the machine on Any program called "Run" in drive 1 will do the same

To use your own cartridges, each one must first be set up with the *Format* command This configures the cartridge and wipes it clean For this latter reason it is important never to *Format* a used cartridge as all your programs will be erased The statement has the general form

```
FORMAT m ;d name
```

where '*d*' refers to the drive number (from 1 to 8) and '*Name*' is the title permanently assigned to the cartridge As will be seen the *Format* command also has other functions — the first single-letter string determines it — 'm in this case

The procedure for *Saving* programs and data to cartridge is similar to that used for cassette For example to *Save* a program called *Test* to a cartridge in drive 3 one uses *Save* "m 3 test" This syntax is not accepted by a Spectrum, unless the interface is connected

Software protection

As with cassette programs arrays bytes and screens can be *Saved* and *Loaded* (but about 50 times quicker) though there are a couple of differences The first point is that you cannot *Load* null string files eg *Load* "m 3 and the second is that a program *Saved* with *Line* such that it auto executes cannot be *Merged* This latter feature has been added I suspect to protect commercial software

Another protection feature is that a file with a name starting with *Chr$ 0* will not appear in the cartridge catalogue and thus will be invisible to the user The statement *Cat d* (where *d* is the drive number) lists on the screen all the files on that cartridge except for the 'invisible' ones already mentioned It also shows how long each file is and how much room is left on the cartridge

In addition this statement shows how much of the 100K cartridge is actually in working order (!) — the manual says that at most only 10 percent of it will be unusable at any time The manual also stresses the importance of keeping backups on cassette as the life-span of a cartridge is, it says, limited Just how limited is not yet known!

Each cartridge has a write-protect tab similar to cassettes that can be poked out

Sinclair computer engineer John Mathieson

with a screwdriver to prevent erasure of files or re-formatting It can be covered with tape at a later date to allow you to write it again

It is also possible to do limited file handling with the Microdrives but only serial access files are permitted and even they have limitations To create a file, the *Open* statement must be used to create a stream Usable streams are numbered from 4 to 15 and to use, say, stream number 4 with drive number 6 the required statement would be

```
OPEN #4 m 6 test
```

which would prepare the file 'test' for writing to or reading from (but not both) To send data to it, use *Print #4* followed by the data To read data from it, the statement *Input #4* will read variables or the *Inkey#4* statement can be used to read the file a byte at a time

The file-handling in general is not as flexible as one would expect when using a true disc-based system The Microdrives do have a slow access time compared to discs of about 3.5 seconds but the transfer rate of around 16K bytes per second is just as fast if not faster This means that the Microdrive usually takes much longer to find a program on the cartridge than to read it into memory

RS232 is an international convention for sending data between computers and other computers or equipment On the Spectrum it can be used for both input and output using Basic statements

There are two types of RS232 files on

AT LAST! THE

the Spectrum — a text file ("t") for sending listings and text and a binary file (b) which handles bytes directly with no conversion. For example with a printer connected to the port, a text file would be most suitable as the Spectrum keywords are de-tokenised into individual characters.

A stream must first be opened and then configured. To open a stream for RS232, statements take the form

```
Open #c;f$
```

where c is the stream number and f$ is the single character filename. For an RS232 text file on stream 4 this would be

```
OPEN #4 t
```

Next the baud rate (which is the speed of data transfer) must be defined — this is done with the format statement. For a 600 baud printer this would be *Format "t",600* (for technical readers the data is fixed at 8-bit, no parity and one stop bit).

When a stream has been configured as just described data can be sent and received from whatever is connected. In this example a program listing can be produced with the *List #4* statement and text can be sent with the *Print#4* statement.

With a text file, all character codes above 164 are de-tokenised into the relevent Ascii characters, and codes below 32 (except 13) are ignored. When a Spectrum code 13 is to be sent, both a carriage-return (code 13) and a line-feed (code 10) are generated which should be satisfactory for most printers.

However there is one glaring omission from the RS232 software — you cannot use the *Tab* command with a printer. This will make many existing programs incompatible as well as making neat output from new programs much more difficult.

To send control codes to RS232 printers and to up- and down-load programs between computers a binary RS232 stream should be used. It can be set up by a similar method to the text file but with the filename "b". This stream does no conversion of characters so listings are sent as bytes with no de-tokenisation, and line-feeds are not generated after carriage returns. In addition *Input #* and *Inkey#* statements can be used to read characters from an RS232 device, such as a terminal, or another computer.

Although it is not made very clear in the manual, only one RS232 device may be connected at a time. The RS232 socket is a 9 pin D-type socket, as used on most joysticks.

A network is a method by which many computers can be linked by a fast data transfer method to communicate between each other, and to 'share' expensive peripherals, such as printers. With the interface, up to 64 Spectrums may be networked via simple 2 core leads terminated in 3.5mm jack plugs.

The data transfer rate is about 5K bytes per second. This incredible speed is due to the fact that no handshaking at all is carried out — if one user sends something to you and you have not set up your Spectrum to receive it, it is 'lost' — the transmitting Spectrum will not wait for the receiver to be ready unlike most other data transfer methods such as RS232.

To use the network for data, *Format* and *Open* statements are again used with the filename "n". *Print#*, *Input#* and *Inkey#* commands are used to transfer data in a similar way to the Microdrives and RS232.

Share expensive peripherals

It is also possible to transfer programs again at about 5K bytes a second between users. For example suppose you have a program in station 1 and your friend at station 4 would also like it — first of all he types

```
LOAD * n 1 "filename
```

to inform his Spectrum to wait for a program. Then you type

```
SAVE * n 4 filename
```

and almost immediately your friend has your program. If required he can then *Verify* it. As with the usual *Save* and *Load* statements bytes, screens and arrays can be transferred between users.

As well as device-specific commands, there is a general purpose *Move* command that copies data from one device to another of any sort. It can also be used to copy files from one cartridge to another, so one of the first things that the software companies will come up with must be a method to prevent the command being used to pirate their software.

When using the interface 16K owners in particular should be aware of the amounts of Ram that it uses to operate — each Microdrive stream uses just under 600 bytes and when networking a further 200 bytes are required.

Compatibility with most existing cassette software should not be a problem, memory space permitting, but certain programs having machine-code in Rem statements will no longer work. This is because the memory location at which a Basic program begins, which is 23755 on a bare Spectrum, can and does, move about when the interface is connected. Most companies who read the relevent section in the original Spectrum manual, will not be surprised by this and have already catered for it but there are a few whose software will no longer Run.

Conclusions

Well Sir Clive has done it again! After slashing the prices of home micros he is now set to slash the prices of disc-type storage devices. The Microdrive may not be as good as a 5¼in disc drive but it is almost as fast and about a tenth of the price! It makes the (more expensive) dedicated cassette players for machines seem ridiculously obsolete and over priced.

The RS232 facility is useful, but not particularly well implemented — it is much easier to drive printers from any of the independent Centronics type interfaces now available for the Spectrum. The networking facility should make it more attractive to schools but stand-alone Spectrums with a Microdrive are so cheap that the whole point of networking seems to have been lost.

The product is excellent — let us hope that the delivery delays of about three months for every new Sinclair product since the MK14 are not repeated. ■

MICRODRIVE

Money Snake

A game for the unexpanded Vic20 by Ian Craighill

Money Snake for the unexpanded Vic20 just fits into the 3 5K memory

The object of the game is to guide your greedy snake Fred around a room, eating pounds and the occasional diamond. But, beware — these goodies can change to deadly dollars

If you hit the wall, or your own body, then you die with a spectacular explosion You gain 10 points for each pound you eat and a mystery number of points for each diamond

Other features of the game include pause button running score high score and tunnels in the walls

Program notes

The hardest part of the game to program was the movement of the tail (*Tp*) A *Peek* in lines 470-500 checks the positions above, below left and right of the tail for the body The tail then moves in the direction of the body, covering the snake's trail

Lines	
0-10	Rem statements
14-40	High resolution graphics
300 335	Sets screen
340	Do you wish to move?
375	Pokes head
400-430	Moves head
450-460	Checks surroundings
470 500	Moves tail
525-560	Prints diamond or pound
570-600	Eats diamond or pound
700 730	Explosion
770-800	End routine
810-890	Instructions
900-920	High score



```
0 REM FOR THE UNEXPANDED VIC 20
1 REM **************
2 REM *    MONEY    *
3 REM *    SNAKE    *
4 REM *             *
5 REM *      BY     *
6 REM *             *
7 REM *   (C)IAN    *
8 REM * CRAIGHILL   *
9 REM *             *
10 REM**************
12 SC$="NOBODY"
13 GOSUB810
14 RESTORE
15 FORZZ=7176TO7199 READOO POKEZZ
   OO NEXT
20 DATA60,126,255,255,255,255,126,60
40 DATA60,66,129,129,129,129,66,60
   0,254,254,254,254,254,254,254
300 SR=36879 CO=30720 S1=36876 H=1
   T=160 HP=7924 TP=7928
310 A$="Z" M=0 S=7703 SC=0 K=3
315 POKE36869,255
320 POKESR,26 POKE36878,15 PRINTCHR
   $(147)"
330 FORP=HPTOTP-1 POKEP,H POKEP+CO
   5 NEXT
332 FORP=7702TO7723 POKEP,4 POKEP+
   CO,0 POKEP+462,4 POKEP+462+CO,0 NEXT
333 FORP=7702TO8164STEP22 POKEP,4
   POKEP+CO,0 POKEP+21,4 POKEP+21+CO,
   0 NEXT
334 PRINT"        "
335 PRINT"  "SC$ HI PRINT"
   "
340 GETB$ IFB$=""THEN360
350 A$=B$
360 GOSUB470
365 POKETP,T
367 M=M+1 IFM=20THENM=0 POKES1,0
   POKES1,0 GOSUB520
370 GOSUB400
375 POKEHP,H POKEHP+CO,5
380 GOTO340
400 IFA$="P"THENGETC$ IFC$<>""THENA$
   =C$ GOTO405
402 IFA$="P"THENGOTO400
405 IFA$="A"THENHP=HP-22
410 IFA$="Z" THENHP=HP+22
420 IFA$="," THENHP=HP-1
430 IFA$="." THENHP=HP+1
450 IFPEEK(HP)=4ORPEEK(HP)=1ORPEEK
   (HP)=164THENGOTO700
460 IFPEEK(HP)=156ORPEEK(HP)=218THENX
   =30 K=K+1 SC=SC+10 Z=212 GOTO 570
465 RETURN
470 IFPEEK(TP+22)=H THEN TP=TP+22
   RETURN
480 IFPEEK(TP-22)=H THEN TP=TP-22
   RETURN
490 IFPEEK(TP-1)=H THEN TP=TP-1
   RETURN
500 IFPEEK(TP+1)=H THEN TP=TP+1 RETURN
520 IFPEEK(S)<>156ANDPEEK(S)<>218
   THEN530
525 POKES,164 POKES+CO,0
530 S=INT(RND(1)*434)+7702
540 IFPEEK(S)=H OR PEEK(S)=4THEN
   GOTO530
545 CV=INT(RND(1)*5)+1 IFCV=1THEN555
550 POKES,156 POKES+CO,5 RETURN
555 POKES,218 POKES+CO,2
560 RETURN
570 IFPEEK(HP)=218THENSC=SC+INT
   (RND(1)*5)*10 X=30 Z=241
575 POKESR,X PRINT"
   ",SC
580 FORP=1TO10 POKES1,Z POKES,3 POKES,
   2 FORPP=1TO20 NEXT POKES1,0 FORPP=
   1TO10 N
EXT
590 POKES1,0 FORPP=1TO15 NEXT POKEHP,
   1 POKEHP+CO,5 NEXT
592 POKESR,26 GOSUB400 POKEHP,H POKEH
   P+CO,5
600 GOTO375
700 N=TP FORP=1TO10 POKE36877,135
710 TP=N H=1 FORY=1TOK GOSUB470 POKET
   P,2 POKETP+CO,INT(RND(1)*8)
715 NEXT
720 H=2 TP=N FORY=1TOK GOSUB470 POKET
   P,1 POKETP+CO,INT(RND(1)*8)
725 NEXT POKE36877,0
730 NEXT
770 POKESR,25
772 POKE36869,240 PRINT"BAD
   LUCK" PRINT"BUT YOU SCORED
   "SC""
773 IFSC>HI THENHI=SC GOSUB900
775 PRINT"" P=1 FORI=1TOLEN
   (SC$) PRINTMID$(SC$,P,1),
   FORG=1TO100 NEXT
   P=P+1
776 NEXT PRINTHI PRINT"IS THE
   RECORD HOLDER"
780 PRINT"
   PRESS ANY KEY"
790 GETC$ IFC$=""THEN790
800 SC=0 GOTO14
810 POKE36869,255 POKE36879,25 PRINT
   "MONEY SNAKE" PRINT"
   "
820 PRINT"EAT THE  OR  "
   PRINT"BEFORE THEY CHANGE"
   PRINT"
825 PRINT"TO DOLLORS"
830 PRINT"AVOID DOLLORS WALL &
   " PRINT"10 PTS=1 POUND"
840 PRINT"+1 MORE SEGMENT="
   PRINT"   PRESS ANY KEY"
845 GETC$ IFC$=""THEN845
850 POKE36869,240 PRINT"
   CONTROLS" PRINT"
   "
860 PRINT"P...PAUSE" PRINT"A.
   ..UP" PRINT"Z...DOWN" PRINT"
   ,...LEFT"
870 PRINT"....RIGHT" PRINT"
   PRESS ANY KEY"
880 GETC$ IFC$=""THEN880
890 RETURN
900 PRINT"ENTER YOUR NAME HERE"
   INPUTSC$ PRINT""
910 IFLEN(SC$)>7THEN900
920 SC$=SC$+" WITH" RETURN
READY.
```





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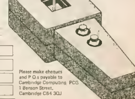
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CAMBRIDGE COMPUTING

A little micro music

***David Kelly** talks to ex-Buzzcock Pete Shelley*

Pete Shelley — ex-leader of the punk band *The Buzzcocks* — has a new solo album out, featuring a ZX Spectrum program.

The program, to be found at the end of the second side of the LP *XL1*, is one of the first attempts to mix music and computers. The ZX program runs for the same duration as the two sides of the album — around 40 minutes — and is written to be played in time with the record.

Both record (or cassette) and computer program are started simultaneously. As the music plays, the lyrics from the song unfold on the screen, together with simple graphic displays to represent the mood of each track.

Okay, so these first efforts, including Pete Shelley's Spectrum program on *XL1*, are fairly crude — limited by memory space more than anything — but it could presage the start of something big. Pop computer games might even take over from pop videos.

In Pete's case, the computer track idea grew out of a real enthusiasm. When the ZX81 dropped to £70 he bought one and was hooked. In December last year, he bought a Spectrum and began tinkering around with it.

In many ways his interest in computing is mirrored by changes that have been taking place in the music industry — making a record is a very different process now from even two years ago — mainly because of the impact of new technology.

Pete's background has helped. He learnt computing at school. "At first there were hundreds of people interested in all the wonderful things that a computer offered, just around the corner. But when it came down to ploughing through Cesil and learning Basic, the numbers began to dwindle and it ended up with only a few of us.

"Then I went to Bolton Tech doing electronics and they had a PDP8 computer. It was the size of a double wardrobe with a maximum of 4K user Ram between four terminals.

"After a while, I began dropping out of lectures to get all 4K to myself — programming it to play *Jingle Bells*!"

Pete left college and his musical career began. "The Buzzcocks were a five-year sabbatical from computers," he grins.

Rather more than that, they were one of the few bands to achieve success from the punk boom and survive its aftermath. They played their first gig on July 20, 1976 and during their five years together they toured extensively both here and in the US and had a string of eight singles — written by Pete — each of which got into the top 50 chart.

The Buzzcocks split in 1981 and he began work with producer Martin Rushant on a solo album which became the *Homosapian* LP.

The demise of The Buzzcocks almost exactly coincided with the arrival in the UK of the first of a new generation of electronic music machines — the Roland Microcomposer.

"We woke up to an entirely different way of working. Between the two of us we could produce the sound of a whole band — exciting to say the least.

Up until the Roland, the problem with synthesisers had been that you still had to play them — usually with a conventional keyboard. But the Roland was different — it could be programmed. "You worked out what notes you wanted and then programmed them in — you didn't have to be a Rick Wakeman to play it!"

The machine really was a breakthrough. Up until then, sequencers had all been analogue. The Roland made use of the increasing cheapness of Ram to store all the information in digital form. On each channel you could program the pitch, the step (how long to the next note) and the gate (duration) — and there were eight channels. "Instead of using a synthetic drum sound we could store in digital form the sound of a real drum and program that in wherever we liked. Using the machine's 99 patterns and building up chains we could work up a whole drum routine — drum fills, back beats, the lot.

"In many ways we were just learning to play a new instrument — the computer."

Since the Roland there have been other machines taking things even further, such as the Fairlight Computer Musical Instrument which has two disc drive storage units and uses elaborate file handling to create sounds, building up the music on disc and from there straight into the studio mixing desk.

The most advanced of these machines is the new Synclavier 2 from New England Digital, a US computer manufacturer. It uses a more advanced — 50KHz — sampling rate to build up a very accurate digital picture of a particular sound. Up to 30 seconds of music can then be stored on 5M Winchester hard discs. This machine has all sorts of uses. For example, if the backing vocals go wrong at one place the sound from another section can be digitised and then programmed in the gap.

A natural step

While making the album the idea of having a computer program with the record just evolved as a natural step. Originally it was to be a flexidisc included with the record. The idea was just to have a program that would print up the words to the songs in time with the music. "I wrote a program for the *Telephone Operator* track in Basic with the words held as a string array — and it worked first time!

"I was extremely surprised, because I'm not one of those structural programmers — I just sit down and compose. I showed it to a friend of mine — Joey — who had just graduated in Computer Science and between us we worked out the routines for the album in machine-code."

Originally it was going to be for one track — then it became the whole LP. Then it became a track on the LP rather than a seperate flexidisc. Then they added in some graphics. "It sounded easy to start off with, but on the Spectrum the *Circle* commands are slow. We had to get new routines to draw circles and lines and for scrolling quickly."

The final result — running on a 48K Spectrum — is quite impressive given the limitations of the machine and the fact that the programs have to run for a full 40 minutes. Just the number of words to be printed out has meant that the graphics had to be kept fairly simple.

"We explained what we were doing to Island Records and they said it would never catch on — 'no one will want to watch it twice,' they said. It took a demonstration to really get everyone involved.

"And we will certainly do it again. There will be a track on the next single and we will do a lot more with the graphics routines. On *XL1* we were very limited for space.

"It will go as far as we can take it. At the moment it's good just to be able to put the words on, but it'll be interesting to see what happens in the next couple of years.

"Someone is bound to link up a computer to a compact disc player. Compact discs are the coming thing and there are plenty of spare bytes floating around in them. How about an interactive game linked to a music track?" ■

Arcade amusements!

***Brian Cadge** takes a critical look at the growing ranga of software for the Dragon 32*

Many new companies or at least new to the Dragon have now started producing game programs for this machine In this review of the latest software (mainly arcade type) we look at what these companies have to offer — their prices are often as high as the established companies but how does the quality compare?

Reversi from Coppice Software is the ancient game of *Othello* The program is very well packaged and comes complete with an extensive playing manual Once the Basic program has been *Loaded* and *Run*, a short machine code move/search routine is *Loaded* from tape

Several options are available including play the computer or a friend play orange or cyan hard or easy level The screen shows the playing board in hi resolution graphics, with a message below showing who is to move next

The game of *Reversi/Othello* In case anybody doesn't know, is played on a standard chess board The object is to form a bridge between the piece you place on the board and a piece already there Any opponent's pieces caught between them are turned over (reversed) to become your own pieces The winner is the player with the most pieces on the board at the end of the game

Back to this version — the board display is rather small and the playing pieces on it are even smaller Using the second colour set as it does (colours 5 to 8), means that you cannot differentiate between the pieces on a black and white tv and it is not very clear on a colour one either



As the program uses machine code routines it responds quickly and plays a good standard of game There is a nice routine at the end of the game which displays the Dragontree logo and plays some music though why this title page is at the end rather than the beginning is a mystery My favourite version of *Othello* is still *Flipper* by Microdeal but at half the price this version from Coppice is definitely worth considering

The next game *Wizard* from Wizard Software, doesn't really qualify as an arcade game either The player as a prisoner of a wicked wizard has to collect bats toads newts, lizards and other nasties in order to make a magic potion to escape

The low-res graphics screen is used, split into two halves — the upper half shows how much of each ingredient you have so far obtained the lower half displays a map showing your position and the position of the other objects (by their initial letter) and unknown territories (coloured blocks) Movement is achieved by using the arrow keys If you move into a coloured square a message appears saying where you are and what has happened All the while, the map scrolls up towards the bottomless pit at the top

I found this game rather mundane to play — the unimaginative use of graphics and lack of much sound did not help matters The game may possibly appeal to the very young

Aliens+ also from Wizard Software is *Loaded* as a Basic program but is written almost entirely in machine code — the Basic being used to *Poke* the code into memory and then execute it The game is *Space Invaders* — the traditional game with no extras There are no instructions with the cassette inlay but full playing instructions are included in the program

The game takes ages to get going but when it does eventually get past the title page the graphics are very good using mode 3 The use of the arrow keys rather than a joystick seems strange — it was also annoying as the keys were most unresponsive and resulted in me being killed very frequently! In all other respects this is a faithful copy of the original with 48 invaders motherships shields and four laser bases per wave The speed is not particularly high but gradually increases up to the fourth wave where it reaches maximum The score and hi score are also shown

Aliens+ is a good version of *Space Invaders* but if like me you feel that this particular arcade game has had its day you should think twice before paying out £7 95

Shards Software's *City Defence* is a faithful reproduction of that other old arcade game, *Missile Command* The program starts with a colourful title page and then asks whether instructions are required There are four skill levels but being written in Basic the game is still slow even on level four

The right joystick is used to control your sights and to fire your laser The graphics used are not the highest available (mode 1) presumably to speed up the game sound is also used to some effect *City Defence* was the only game in the whole review with which I had any trouble *Loading* as it was recorded at a rather low level

There is little more to be said about this game but maybe I am biased as I was never very impressed by the original *Missile Command* (what is the fascination of watching lines being drawn down the screen?) But at only £5 75 this is one of the cheaper games available for the Dragon and so may still be worth considering if you are a fan of this game

The most expensive game in this review was *Drone* by Cable Software at £8 75 For this you get an excellently packaged game in a book type or mini video box — a keyboard overlay and operation manual are also included Having *Loaded* and Run the program it then *Loads* a title screen and some machine code from tape Quite what this machine code does is a mystery nothing obvious when dissassembled and it certainly doesn't speed up the game at all

Instructions are given by *Troff* (*Troff* is the Dragons command for trace off if you know the command for trace on you will

have guessed which film this game is based on) Don't be fooled into thinking that *Troff* is a marvel of speech synthesis it's not On side 2 of the tape is a recording of the instructions spoken through a reverb microphone sounding like something out of *Blake's Seven* or *Dr Who* Synchronised to the speech are a number of illustrations appearing on the screen

The object of the game is explained in the operation 'manual' (better known as a sheet of folded paper) including some hints to read in times of despair In brief the idea is that the player controls (from the keyboard) a Datatank inside the computer which must get past all the bugs and evil drone fleets to eventually kill the real bad-guy of the game the Rom guardian This is not as easy as it sounds A 3D simulation of your forward view is shown together with a scanner showing bugs drones and laser blasts Other pertinent information is also displayed

Despite the game's advertised 'Machine code' presentation and routines it is still incredibly slow You've almost got time to go off have a cup of tea come back, get comfortable again all before the drone has traversed from the far left of the screen into your sights Another annoying feature is that when you get killed (as frequently happens!) you have to say no to instructions and wait to be transported into position, which means there is a delay of almost a minute between each game

Also included is an optional end of game printout if you have a printer connected At £8 75 it is a little expensive despite its excellent packaging A lot of thought has obviously gone into this game to give it the many features that it has making it a worthwhile game to add to your collection if you can afford it

I have left the best three games to the end *Championship Darts* is a two player game which is very true to the original pub game The program starts with an attractive title page and full optional playing instructions Next the player's names are entered, followed by the length of the game (anything from 2 to 999) All of the usual championship rules apply — eg finishing on a double

A flashing cursor speeds round the dart board which is shown in hi-res (mode 4) black and green graphics somewhat reminiscent of the *Wheel of Fortune* games found at holiday resorts Pressing any key stops the cursor and starts another at the bottom right of the screen, stopping this one decides which score you get — treble double, single miss bulls eye etc Some sound is also included OK, so there is not much skill involved but it's good fun!

Obviously to enjoy the game you need two players making this an ideal game for parties or family get-togethers If you manage to get the magical 180 then there is a suitable whoop from the speaker and 180 flashes up in giant characters At £5 95 this is one of the best value two-player games of its type that I have seen for the Dragon

The two final games in this review are both from J Morrison and are *Vultures* and *Bonka* *Vultures* comes well packaged without *Loading* instructions The game autoruns on *Loading* and is written entirely in machine code The right joystick is required to play the game and to select the skill level from Slow, medium or fast

The best way to describe this program is to say that it is a little like *Galaxians* but with birds An army of vultures fly at the top of the screen with one swooping down towards you dropping eggs (or is it something else?) on you You control the familiar laser base at the bottom of the screen You get three lives with which to kill off all of the birds If you manage this the eggs at the top of the screen start to hatch into Superbirds!

Hi res graphics and sound are used to the full in this game, with excellent animation The score hi score and number of lives remaining is also shown at the top of the screen My only complaint about the game is that occasionally when a bird is hit at the top it is a different bird which then disappears! As the game is so fast you only tend to notice this (or even care about this) when watching someone else play At £6 95 this game is excellent value

Finally to *Bonka*, the game you must all have heard of by now Again this program is written in 100 per cent machine code and autoruns on *Loading* The instructions are given in a graphics mode not available to Basic which gives the scrolling text a very weird effect

The object of this game is to climb the ladders and bash holes in the ground in order to trap the meenies When a meanie falls into a hole you must rush over and bonk him on the head in order to kill him If you take too long he will climb out filling in the hole behind him The merest touch from a meanie and you are electrocuted

There are four speeds of play and the player can choose how many meanies there will be at the start When you have killed off all of the first batch even more appear The highest scores are shown in a 'Hall of Fame' at the end of the game The sound is very good indeed and the graphics are outstanding

Joysticks are not required to play though it would have been nice to be given the option as the game is played with the arrow keys and the space bar The key is very responsive in this game so it is not a real disadvantage *Bonka* is £1 more expensive than J Morrison's other game *Vultures* but it is well worth it

The standard of software for this machine seems to be rising slowly but surely — thankfully all of the prices are still reasonable If there is one point that shows through when reviewing arcade games it is this — the originals were written in machine code If the copies are going to get anywhere near the standard of these originals the software companies are going to have to stop clutching on to Basic and start writing in machine code The programs must be fast and well animated to retain their appeal — no doubt the message will slowly get through in terms of sales — let's hope so ■

Firm	Program	Cost	Value (1-10)
Coppice Software 7 March Street Kirton in Lindsey Lincs DN21 4PH	*Reversi*	£4 95	4
Wizard Software PX Box 23 Dunfermline Fife KY11 5RW	*Wizard* *Aliens+*	£6 50 £7 95	3 5
Sharda Software 10 Park Vale Court Vine Way Brentwood Essex	*City Defence*	£5 75	4
Cable Software 83 Nevile Road Bedfordshire	*Drone*	£8 75	6
Shadow Software 8 Hallgate Thurnscoe S Yorks S63 0TU	*Championship Darts*	£5 95	9
J Morrison (Micros) 2 Glenedale Street Leeds LS9 9JJ	*Vultures* *Bonka*	£6 95 £7 95	8 8

Sorting a routine

***Bryan Skinner** looks at the advantages and disadvantages of two different sort routines*

At some time or other you will need to use a "sort routine" in a program You might want to sort a list of names into alphabetical order or a group of numbers into descending order

If you consult a book on programming you will probably find a flowchart or listing showing either the "Bubble Sort" or "Insertion Sort" I find it curious that most such texts provide examples of the slowest and least efficient algorithms available!

This article will compare one of the fastest sort routines (the Shell Metzner sort) with its poor cousin the Bubble sort You should find it relatively easy to convert the coding to suit your own requirements as the coding is eminently transportable from one dialect of Basic to another

It is interesting to note that while the concepts underlying the Shell Metzner sort are too complex for discussion here the coding itself requires little extra in the way of variables program lines etc than the Bubble sort!

At the heart of any sort routine lie two operations

(i) The comparison of two items
(ii) the exchange of two items if necessary

In a flowchart this is represented as

IS A > B ? — yes → EXCHANGE A WITH B
no

Comparison is easy but exchanging the values held in two variables requires the use of a third variable to temporarily hold the value in one of the variables being exchanged That is, to achieve the following A ⇆ B

we must use the pattern

A ← 2 — B
1 3
T

The coding of this in Basic is

```
1000 T   A
1010 A   B
1020 B = T
```

As an example of the sort operations in action we might set up an array *N* containing 10 random numbers between 1 and 100 thus

```
10 NN - 10
20 DIM N (NN)
30 FOR I = 1 TO NN
40 N (I) - RND (100)
50 NEXT
```

Now we can refer to each number in the array by using a subscript as *N (X)* where *X* is the position of the number in the array To exchange the 3rd and 4th items the coding would be

```
1000 T - N(3)      store the 3rd item in T
1010 N(3) = N(4)     move the 4th item to the 3rd
1020 N(4) = T      put the 3rd item in 4th place
```

or in the general case

```
1000 T   N(A)
1010 N(A) - N(B)
1020 N(B)   T
```

where *A* and *B* are the positions of the items to be exchanged We can call up such a fragment of code following a comparison

```
   PART OF SORT ROUTINE
100 IF N(A) > N(B) THEN GOSUB 1000
   REST OF SORT
1000 T - N(A)  N(A) = N(B)  N(B) - T
1010 RETURN
```

Clearly the next step is to embed line 100 in a routine that will compare pairs of items until the list is sorted And therein lies the rub!

The Bubble sort as its name implies "bubbles" lower valued items to the head of the list It does this by moving down the list and comparing adjacent pairs of items which are exchanged if necessary Fig (1) shows the method in diagrammatic form The double-headed arrows indicate a comparison which results in an exchange

The Bubble sort makes no use of the fact that once a pair of items has been exchanged then they do not need to be compared again In its crudest form, the Bubble sort will have to make $N * (N - 1)$ passes through the list in order to sort it. The coding given here reduces this by testing for swaps after each pass — obviously if no swaps have been made the list has been sorted

Fig (4) compares the two routines in terms of the number of comparisons and exchanges made for different sizes of lists

You can see that while there is little difference between the two methods of small numbers of data the difference increases dramatically as the number of data points rises

Either of these two sort routines can easily be adapted to allow you to sort a two-dimensional string array by a given column or field In a previous article I described how to set up a simple data base in an array called *Ar$* whose columns held string items such as name address phone etc

To sort such an array by names requires only a few alterations to the sort routines The basic problem lies in the fact that we now need to exchange one row for another rather than single items This can be done in a simple *For* *Next* loop as follows

```
1000 FOR I = 1 TO NF      NF is the number of
      fields/columns
1010 T$   AR$ (A,I)
1020 AR$ (A,I) = AR$ (B I)
1030 AR$ (B I) = T$
1040 NEXT
```

You should recognise the basic exchange routine in lines 1010 1030 simply embedded in a loop which ensures that all columns are exchanged between rows

The only other alterations required are to specify which field to sort on and to alter the exchange routine If we want to sort by name, this is the first field or column of each row, so line 130 of the Shell Metzner routine becomes

```
130 IF AR$(I 1) < = AR$(L,1) THEN 160
```

and line 140 will be the *For* *Next* loop or a call to the exchange routine as a subroutine

Using techniques described in previous articles you should now be able to set up a menu to allow the user to sort the array on any given field ■

Fig (1)

sorted list

```
6  3  3  2  2  1
3  6  2  3  1  2
2  2  6  1  3  3
5  1  1  6  4  4
1  5  4  4  6  5
4  4  5  5  5  6
```

Fig (2) Bubble sort coding

```
60 FOR OL   1 TO NN      outer loop
70 EX   0      no exchanges yet
80 FOR IL   1 TO NN - OL      inner loop
90 IF N(IL) > N(IL + 1) THEN GOSUB 200
      compare swap
100 NEXT IL      loop (inner)
110 IF EX   0 THEN 130      quit if done
120 NEXT OL      loop (outer)
130 FOR I   1 TO NN
140 PRINT N(I)                  print results
150 NEXT
160 END
200 T = N(IL)  N(IL) - N(IL + 1)  N(IL + 1)   T
      swap items
210 EX = 1      flag exchange
220 RETURN      back to program
```

Fig (3) Shell-Metzner coding

```
60 M   NN
70 M = INT (M/2)      start at middle
80 IF M = 0 THEN 200      all done
90 K = NN - M
100 J = 1
110 I - J      set variables
120 L = I + M
130 IF N(I) < = N(L) THEN 170      skip swap if items
      in order
140 T - N(I)  N(I)   N(L)  N(L)   T      swap
150 I - I   M
160 IF I < 1 THEN 170 ELSE 120
170 J = J + 1
180 IF J > K THEN 70
190 GOTO 110
200 FOR I = 1 TO NN
210 PRINT N(I)
220 NEXT
```

Fig (4) Comparison of sorts

Type of sort	Sample size			Operations
Bubble	10	100	1 000	
	40	4 890	450 000	Comparisons
	20	2 600	240 000	Exchanges
Shell-Metzner	30	825	12 900	Comparisons
	10	380	57 000	Exchanges

A shoal of fish. . .

J Coote provides an introductory guide to turtle graphics

For some readers the concept of turtle graphics needs no introduction — they can rush eagerly to the programing section For those still reading, I have to pass on some of the infectious enthusiasm that people have found for a little turtle (American for tortoise) that can be guided around the screen drawing lines

The turtle responds to strings of English commands such as draw and turn and in the process sketches line drawings of any desired objects An object can be given a name and the turtle will then respond to the name by drawing the object Thus, a fish would become a shoal of fish So from a few basic commands you can create your own vocabulary of objects which can be drawn anywhere on the screen at any size

Drawings can be developed in a trial and error manner using this friendly language which gives no out of screen error messages It is fun to generate simple objects and then combine and manipulate them in order to explore geometric relationships It has also been found that young children can teach themselves geometric skills because the language encourages exploration of angles lengths and forms

In this program the turtle is invisible partly because it would take a long time to draw and partly because of the complexity of undrawing it If you do get lost you can always draw 10 then — 10 to reveal your position and direction

The commands available in this program are presented here with the necessary parameters and a brief description of their functions

goto x y d	go to x,y and point at d degrees to the horizon Initial values are 128 88 0
draw n	draw a line of length n pixels from the current position in the pointer direction
turn d	change direction by d degrees positive d is anti-clockwise
move n	move n pixels from the current position without drawing a line
size n	LET size = n
repeat n( )	repeat the commands within ( ) n times
object name – end	store the commands — under name
erase	clear the screen
list	list the defined objects to the screen
print	print the defined objects to the printer
copy	copy the screen to the printer
save filename	save the defined objects on tape (in 2 files)
load filename	reload objects from tape
stop	end the run

The commands and data are entered on one line with spaces as separators The commands are lower case and can be abbreviated to the first three letters The numbers can be expressions such as *10* Cos Pi /3*, but if an error occurs then a warm restart is required by typing *Goto 2*

A simple example is shown in Figure 1 to illustrate the use of "draw" and "turn" In this example, the turtle draws a box and is returned to its starting point and direction

Figure 2 illustrates the use of repeat to draw a larger box and shows the effect of wraparound This facility causes a line drawn across one edge of the screen to reappear at the opposite edge as if the edges were directly connected This facility was intended to make the program user friendly, but it can be deliberately used to produce patterns such as Figure 3

Figure 4 illustrates the use of "object and "repeat" to draw a flower while Figure 5 illustrates the use of "size" and the use of "object" to nest repeats Figure 6 illustrates the use of a function to draw a sky at night picture

When you have gained some experience with these examples and any variations then try to draw a triangle with pre determined length sides Another problem to solve is how to draw a square to fit exactly within a hexagon

The program is structured and easily extended to introduce other commands An example of this would be to introduce left and right in addition to turn Then with these commands available a budding navigator could be set a course around the screen and then challenged to follow it correctly, using left and right

If you do create any further commands you may like to share them with other readers In a following article I will provide a machine code implementation of the turtle which will be displayed while commands are being entered Some suggested extensions are rad/deg additional variables, sound commands using *Circle* and *Draw*, colour, and dynaturtle

In order to illustrate the language's expandability I suggest that the program is entered and Run in stages Lines 1 to 32 100 to 210 430 and 500 to 690 contain the minimum program giving commands turn and draw provided that line 2 is replaced by *Cls Goto 100*

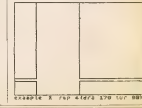
Program notes

The program is structured around these features command list manipulation command recognition and line graphics Command list manipulation is dealt with by the routines in lines 10-46 These routines allow multiple command and data entry on one line by continually bringing the next command or data item to the head of the list When the list is exhausted an appropriate prompt is issued for further entries

The command list recognition is based on comparing the first three letters with known commands and jumping to the relevant routine All routines return to a common point for the next command search

The graphics are based on plotting straight lines which are checked to avoid out of screen error messages If an attempt is made to plot off the screen then the wraparound technique is adopted With this technique it is imagined that the screen is wrapped around so that the sides meet each other and the top meets the bottom Thus, the imaginary screens to

```
example 1  goto 70 30 0 draw 100
turn 90 dra 100 tur 90 dra 100 t
ur 90 dra 100 tur 90
```



either side and above and below are plotted over the central screen ad infinitum

Lines

- **1 & 2** initialise the variable and jump to the command recognition loop at line 100
- **10-24** are the command entry handling routines. When a list of commands is acted upon it is assumed that the command at the head of the list has been enacted and can now be discarded. The next command is located after the first space or comma and then passed on to the command recognition sequence.

  If no more commands are present then the current prompt of either command or number is output on the first input line and a new command list can be entered. This new command list then has its leading and trailing spaces removed to simplify the command searching mentioned in the previous paragraph.
- **30-33** convert the next item in the command list into a number
- **35-37** extract a file name of up to nine characters
- **40 & 41** finds the length of the next command
- **45-46** locate the parenthesis for the repeat function
- **100-138** extract the first three letters of the current command to test against available commands and objects
- **200-390** test for a match with the available commands and immediately goes to the coding for that command. Any numbers that may be required are extracted by the command routine. All commands return to line 100 since all error conditions are avoided. The only exception to this is when a number entry cannot be evaluated in which case a Goto 2 is required to restart
- **400-420 & 450** check for a match with the defined object and replaces the object name by the command list it represents
- **430** announces that no match has been found, prints the remaining command line and prompts for a new command line
- **500** turn. This routine extracts a number from the command list and increments the current angle, a, by n/rad where rad converts n from degrees to radians
- **600-672** forward. This routine extracts from the command list the distance to move in pixels and calculates the plot endpoint. The variable m0 is then adjusted to be the length of the vector to the nearest screen boundary provided this is less than the desired length.

  If a boundary is intercepted then the line is drawn to the boundary and the start point adjusted to the opposite side of the screen as though it were wrapped around. The remaining part of the line is drawn in a like manner.

  In order to avoid collecting roundoff errors, the line is drawn from where the turtle actually is, x2 y2, to where it is supposed to be x1 y1. The values of x2 y2 are then calculated as the rounded parts of x1 y1
- **700-760** object. This routine removes the obj command from the list and copies the list up to either end or the end of line into the object string o$. The number of objects is updated and the start location for the next object is stored in array 0. The copied commands are removed from the command list and interpretation is continued
- **800-860** move. This command is similar to the draw command but no line drawing is done although a point is placed at the new position
- **900-980** save and load are routines by which the object array and string are stored and restored. The number of objects is stored in the last element of array o which limits the number of objects to 19
- **1000** erase clears the screen, draws a border and plots a point at the current turtle position
- **1100-1130** repeat starts by locating the repeat number and the parenthesis. A new command list is then created with the contents of the parenthesis followed by the original command list with the repeat number reduced by 1. If the repeat number is zero then the commands from rep to) are omitted
- **1200-1270** list and print display and print the object list
- **1300** size changes the BASIC variable size which is available for use as a number in the command list
- **1400-1430** goto interprets the next three numbers as the new turtle location and direction x y a. A point is plotted at this point.
- **2100** copy produces a copy of the screen on the printer
- **9000** is a routine for drawing the screen outline ■

Continued on page 20

example 3 tur 20 dra 4610 tur 140 dra 4610

example 4 goto 113 110 0 daisy
hex rep 6(dra 30 tur 60)
daisy rep 6(hex mov 30 tur -60)

example 5 mov -30 siz 100 spiral
spiral rep 20(box size siz-5 tur 10 dra 5)
box rep 4(dra siz tur 90)

example 6 rep 25(goto 256*RND 176*RND 0 siz 10*RND star)
point draw siz tur 120 draw siz
star rep 5(point tur -60) tur -14.48 dra siz*2 tur 151.04 dra siz*2

```
   1 CLS   LET rad=180./PI   LET
o=0   LET o$=""   DIM o(200)   LET
o(1)=1   DIM m(4)   LET siz=10
   2 LET z$="X goto 126 30 0 era
se"   GO TO 100
  10 IF z$="" THEN INPUT AT 0,0;
(c$), LINE z$   LET z$="X "+z$
  11 IF z$(1)=" " THEN LET z$=z$
(2 TO )   GO TO 11
  12 IF z$(LEN z$)=" " THEN LET
z$=z$( TO LEN z$-1)   GO TO 12
  13 GO SUB 20   IF z$="" THEN GO
 TO 10
  14 RETURN
  20 LET l=LEN z$-1   FOR j=9 TO
l   IF z$(j)=" " THEN GO TO 22
  21 NEXT j   LET z$=""   RETURN
  22 LET z$=z$(j+1 TO )
  23 IF z$(1)=" " THEN LET z$=z$
(2 TO )   GO TO 23
  24 RETURN
  30 LET c$="Number>"   GO SUB 10
  LET l=1
  31 IF z$(l)<>" " THEN IF l<LEN
 z$ THEN LET l=l+1   GO TO 31
  32 LET n=VAL z$( TO l)   RETURN

  35 GO SUB 10   GO SUB 40
  36 IF i>9 THEN LET i=9
  37 LET f$=z$( TO i)   RETURN
  40 LET l=LEN z$   FOR i=2 TO l
 IF z$(i)=" " THEN RETURN
  41 NEXT i   LET i=l   RETURN
  45 LET l=LEN z$   FOR f=2 TO l
 IF z$(f)="(" THEN GO TO 47
  46 NEXT f   LET f=l
  47 LET l=LEN z$   FOR e=8 TO l
 IF z$(e)=")" THEN RETURN
  48 NEXT e   LET e=l   RETURN
 100 LET c$="Command>"   GO SUB 1
0
 110 LET l=3   IF LEN z$<3 THEN L
ET l=LEN z$
 120 LET t$=z$( TO l)
 200 IF t$="tur" THEN GO TO 500
 210 IF t$="dra" THEN GO TO 600
 220 IF t$="obj" THEN GO TO 700
 230 IF t$="mov" THEN GO TO 800
 240 IF t$="sav" THEN GO TO 900
 250 IF t$="loa" THEN GO TO 950
 260 IF t$="era" THEN GO TO 1000
 270 IF t$="rep" THEN GO TO 1100
 280 IF t$="lis" THEN GO TO 1200
 290 IF t$="pri" THEN GO TO 1250
 300 IF t$="siz" THEN GO TO 1300
 310 IF t$="got" THEN GO TO 1400
 380 IF t$="cop" THEN GO TO 2100
 390 IF t$="sto" THEN STOP
 400 FOR i=1 TO o   LET m=o(i)   L
ET w$=o$(m TO m+2)
 410 IF t$=w$ THEN GO TO 450
 420 NEXT i
 430 INPUT AT 0,0,(z$)," is not
known ", LINE z$   LET z$="X "+z
$   GO TO 100
 450 GO SUB 20   LET z$=o$(o(i) T
O o(i+1)-1)+" "+z$   GO TO 100
 500 GO SUB 30   LET a=a+n/rad   G
O TO 100
 600 GO SUB 30
 605 FOR k=1 TO 4   LET m(k)=n   N
EXT k   GO SUB 690
 610 IF i<0 THEN LET m(1)=-n*x/i
 615 IF i>0 THEN LET m(2)=n*(255
-x)/i
 620 IF j<0 THEN LET m(3)=-n*y/j
 625 IF j>0 THEN LET m(4)=n*(175
-y)/j
 630 LET d=0   LET m0=n   FOR k=1
TO 4   IF ABS (m(k))<ABS (m0) THE
N LET m0=m(k)   LET d=k
 635 NEXT k   IF d=0 THEN GO TO 6
45
 640 LET m=n-m0   LET n=m0   GO SU
B 590
 645 DRAW x1-x2,y1-y2   LET x=x1
 LET y=y1   LET x2=INT (x1+.5)   L
ET y2=INT (y1+.5)   IF d=0 THEN G
O TO 100
 650 IF d=1 THEN LET x=256   LET
x2=255
 655 IF d=2 THEN LET x=0   LET x2
=0
 660 IF d=3 THEN LET y=175   LET
y2=175
 665 IF d=4 THEN LET y=0   LET y2
=0
 670 PLOT x,y   LET n=m   GO TO 60
5
 690 LET i=n*COS a   LET j=n*SIN
a   LET x1=x+i   LET y1=y+j   RETUR
N
 700 GO SUB 10   LET k=LEN z$   LE
T l=3   IF k<l THEN LET l=k
 710 FOR i=1 TO k-3
 720 IF z$(i TO i+2)="end" THEN
GO TO 740
 730 NEXT i   LET i=k+1
 740 LET o$=o$+z$(1 TO i-1)   LET
o=o+1   LET o(o+1)=o(o)+i-1
 750 IF LEN z$>i-1 THEN LET z$=z
$(i TO )   GO TO 100
 760 LET z$=""   GO TO 100
 800 GO SUB 30   IF n=0 THEN GO T
O 100
 810 GO SUB 690
 820 GO SUB 850   GO TO 100
 850 IF x1>255 THEN LET x1=x1-25
5   GO TO 850
 860 IF x1<0 THEN LET x1=x1+255
 GO TO 860
 870 IF y1>175 THEN LET y1=y1-17
5   GO TO 870
 880 IF y1<0 THEN LET y1=y1+175
 GO TO 880
 890 PLOT x1,y1   LET x=x1   LET y
=y1   LET x2=INT (x1+.5)   LET y2=
INT (y1+.5)   RETURN
 900 GO SUB 35   DIM s$(LEN o$)
LET s$=o$   SAVE f$+"$" DATA s$()
  DIM s$(1)
 910 PRINT #1,AT 1,0, FLASH 1,"N
ow save the second file"   BEEP 1
,12
 920 LET o(200)=o   SAVE f$ DATA
o()   GO TO 100
 950 GO SUB 35   LOAD f$+"$" DATA
s$()   LOAD f$ DATA o()
 960 LET o=o(200)   LET l=o(o+1)-
1
 970 LET o$=s$( TO l)   DIM s$(1)
 980 GO TO 100
1000 CLS   GO SUB 9900   PLOT x,y
  GO TO 100
1100 GO SUB 40   GO SUB 45
1110 LET n=VAL z$(i TO f-1)   IF
n<=1 THEN GO TO 1130
1120 LET z$="X "+z$(f+1 TO e-1)
" rep "+STR$ (n-1)+z$(f TO )   GO
 TO 100
1130 LET z$="X "+z$(f+1 TO e-1)
z$(e+1 TO )   GO TO 100
1200 CLS   FOR i=1 TO o
1210 PRINT o$(o(i) TO o(i+1)-1)
1220 NEXT i   PAUSE 0   CLS   GO S
UB 9900   PLOT x,y   GO TO 100
1250 FOR i=1 TO o
1260 LPRINT o$(o(i) TO o(i+1)-1)
1270 NEXT i   GO TO 100
1300 GO SUB 30   LET siz=n   GO TO
 100
1400 GO SUB 30: LET x1=n   LET x2
=0
1410 GO SUB 30   LET y1=n   LET y2
=0
1420 GO SUB 30   LET a=n/rad
1430 GO SUB 850   GO TO 100
2100 COPY   GO TO 100
9900 PLOT 0,0   DRAW 255,0   DRAW
0,175   DRAW -255,0   DRAW 0,-175
 RETURN
```

A set of values . . .

R Braban presents a program to plot equations for a range of different values

The purpose of this program is to plot an equation over a range of values of x. The equation is entered in line 10 in the form

DEF FNR(X)=f(X)

The program cannot handle infinite values and so the range of values of x should be arranged so this does not happen. The program may use functions such as $f(X)=1/X$, if a suitable range is used such as −2 to 2. In this range the program does not try to find a value of $f(x)$ when $x=0$ and so no difficulties arise.

The program also allows a table of results to be made. The program asks for the step which is the difference between one value of x and the next value of x where $f(x)$ is to be evaluated. A grid can be put over the graph being plotted to give some indication of scale to the graph.

The program was written in *Pmode 4* to get the highest resolution possible.

Program notes

Line	
10	contains the equation to be plotted
40-100	give instructions
110-210	enter the range of values of x and also find the maximum and minimum values of f(x)
220-360	allow you to change the range of f(x) to be plotted
370-490	print out a table of results if required
500-630	plot a grid on top of the graph
640-810	plot out the graph

The speeding up *Poke* may be used but all the usual precautions must be observed. ■

```
10 DEF FNR(X)=1/X*SIN(X)
20 'R.BRABAN 1983
30 PMODE4,1 PCLS
40 CLS PRINTTAB(10),"GRAPH" PRINTTAB
   (9) "-------"
50 PRINT"ENTER FUNCTION IN LINE 10"
60 PRINT
70 PRINT"AND THEN RUN AND ENTER
   X VALUES"
80 PRINT
90 PRINT"THIS PROG. CAN NOT EVALUATE
   1/0" PRINT PRINT
100 PRINT
110 INPUT"ENTER X(MIN,MAX)",XI,XA
120 IF XI>XA THEN X1=XI YI=XA XA=X1
130 IF XI=XA THENPRINT"NOT EXCEPTED"
    GOTO 110
140 YA=FNP(XI) YI=YA
150 FORI=XI TO XA STEP(XA-XI)/255
160 Y=FNP(I)
170 IF YI>Y THEN YI=Y
180 IF YA<Y THEN YA=Y
190 NEXT
200 IF YI=YA THEN YI=YI-10 YA=YA+10
210 CLS
220 PRINT@32*5,"FOR THEN RANGE X=",
    XI "TO",XA
230 PRINT@32*7,"FOR PLOTTED VALUES"
240 PPINT@32*8 "Y MIN=",YI
250 PRINT@32*9 "Y MAX=",YA
260 PRINT@32*10 "DO YOU WANT TO
    CHANGE THE RANGE OF Y PLOTTED",
270 R$=INKEY$ IFR$="" THEN 270
280 IFR$="N" THEN 360
290 IF R$<>"Y" THEN 260
300 PRINT@32*10 "" PRINT@32*11,""
310 PRINT@32*10 ""  INPUT"ENTER Y
320 PRINT@32*10,""
    MIN" YI
330 PRINT@32*10,"", INPUT"ENTER Y
    MAX";YA
340 IF YI=YA THEN YI=YI-10 YA=YA+10
    PRINT"I HAVE CHOSEN Y
    MIN=",YI PRINT"AND Y M
    AX" YA FORDL=0 TO 3E3 NEXT
350 IF YI>YA THEN Y1=YI YI=YA YA=Y1
360 CLS
370 PRINT@0,"DO YOU WANT A TABLE OF
    RESULTS?"
380 R$=INKEY$ IFR$="" THEN 380
390 IF R$="N" THEN 490
400 IF R$<>"Y" THEN 360
410 CLS
420 INPUT"ENTER STEP",ST
430 IF ST<=0 OR ST>=(XA-XI) THEN 410
440 CLS PRINT" X"," F(X)"
450 FORI=XI TO XA STEP ST
460 PRINTI,FNR(I)
470 IF INKEY$="" THEN 470
480 NEXT
490 CLS
500 PPINT@0,"DO YOU WANT A GRID?"
510 R$=INKEY$ IFR$="" THEN 510
520 IF P$="N" THEN 640
530 IF R$<>"Y" THEN 500
540 DY=(YA-YI)/10 DX=(XA-XI)/10
550 FORI=0 TO 255 STEP 255/10
560 LINE(I,0)-(I,191),PSET
570 LINE(0,I*191/255)-
    (255 I*191/255),PSET
580 NEXT
590 CLS
600 PRINT@32*5,"ONE DIV ON
    X-AXIS=",DX
610 PRINT@32*8,"ONE DIV ON
    Y-AXIS=" DY
620 PPINT@32*10,"PRESS ANY
    KEY TO CONTINUE"
630 IF INKEY$="" THEN 630
640 SCREEN1,1
650 LINE(0,0)-(0,0),PSET
660 FORI=XI TO XA STEP (XA-XI)/255
670 XP=255/(XA-XI)*(XA-I)
680 XP=255-XP
690 Y=FNR(I)
700 YP=191/(YA-YI)*(YA-Y)
710 IFYP>191 THEN YP=191
720 IFYP<0 THEN YP=0
730 LINE-(XP,YP),PSET
740 NEXTI
750 IF INKEY$="" THEN 750
760 CLS
770 PFINT@32*10,"DO YOU WANT
    TO ANOTHER PLOT?"
780 R$=INKEY$ IF R$="" THEN 780
790 IF R$="N"THEN END
800 IF R$<>"Y" THEN 780
810 RUN
```

Assembled — part two

***Jeremy Ruston** provides a simple introduction to the intricacies of assembly language*

From now on the addressing modes become a lot more complex In fact you can write adequate programs using just the modes detailed last week. You will probably find it profitable to merely skim over the rest of the modes and go on to read the specific information about each instruction As and when you need to use a new addressing mode you can then refer back to this description It helps to know exactly what the BBC Basic indirection operators *?* and *!* do before you start to digest this section

The first of these more complex modes is pre-indexed indirect addressing In all probability you will never remember the name of this mode but you will remember how it works

First of all the format of this addressing (using *Lda* as an example) is *Lda (&20 X)* In this case the computer adds together *&20* and the contents of the *X* register If the answer to this sum is over 256 the computer subtracts 256 It treats this number as an address in page zero From this address it retrieves two numbers — one from the address indicated and one from the next address after the one indicated The second of these numbers is multiplied by 256 before being added to the first This new number is treated as the address from where the data for the instruction will be extracted

A lot of the time the *X* register will be zero when this mode is used whereupon this mode becomes a simple means for getting the byte pointed to by an address in page zero

In Basic terms the instruction *Lda (&20 X)* becomes *Let A = ! (X?&20) And &FFFF* This simile ignores the complication that occurs if *X* plus *&20* is greater than 256 Only the *X* index register can be used with this addressing mode

Post indexed indirect addressing is similar to pre-indexed indirect addressing In this mode the format is *Lda (&20) Y* You cannot use this addressing mode with the *X* index register — the decision has already been made for you

Using this mode a 16 bit number is retrieved from the indicated memory location and the one following it (in this case the 16 bit number is made up from the bottom 8 bits coming from the contents of location *&20* and the top 8 bits coming from location *&21*) The contents of the *Y* register is then added to this 16 bit number to gain a new 16 bit number The data for the instruction is then called from the location indicated by this number

This mode may not seem particularly wonderful but it is useful in a number of different applications For example, the indicated memory locations could contain the start of a table Then it would be easy to access the *Yth* element of the table — assuming the elements of the table were 8 bits wide

Specifically you could devise a simple table driven program to encode a sample of text to impenetrable code You would do this by simply assigning a different number to each element of the table In fact the code would not be impenetrable but if the code were a computer code such as Ascii or Ebdic we would still have a useful program

Indexed addressing is rather simpler than post indexed indirect addressing but the two modes share some common characteristics Indexed addressing is written as *Lda &20 X* In this mode the address of the data for the instruction is given as *&20 + X* — in other words the Basic equivalent of the above would be *Let A = X?&20* This mode can be used to access tables when you know the address of the table at the time the program is written

The indirect addressing mode which can only be used with the *Jmp* instruction is similar to post-indexed indirect addressing Using this mode the 16 bit address that the *Jmp* instruction must jump to is not given literally rather an address is given where the actual jump address can be found For example the instruction *Jmp (&200)* would pass control to the routine whose address was stored as a 16 bit number in locations *&200* and *&201* All the operation system routines are accessed using indirect addressing — or vectored addressing as it is sometimes called

Relative addressing is only used with branch instructions If you are familiar with the *Goto* statement in Basic you would expect to find an equivalent in assembly language There is one — the *Jmp* instruction — but most jumps inside programs are usually made using relative addressing This is not available with *Jmp*.

What relative addressing means is that you are not jumping to specific addresses rather you are instructing the computer to jump backwards or forwards a certain number of bytes As it turns out you can only jump backwards or forwards by 125 or so bytes

The reason why this mode is so popular is that it can be used with the instructions which do the equivalent of "if this number is larger than that one go off to somewhere else

The status register is where all the flags are held The flags are each 1 bit long If the bit corresponding to a flag is a "1" that flag is set to be set — otherwise it is unset or reset Each of these flags reflect various internal states of the processor

Of the 8 bits, some are not used — notably bit 5 — if you assume the rightmost bit is 0 The other bits are

Bit 0 — Carry flag
Bit 1 — Zero flag
Bit 2 — Interrupt disable status
Bit 3 — Decimal mode
Bit 4 — Break status
Bit 5 — Not used
Bit 6 — Overflow flag
Bit 7 — Sign flag

Having looked at that table it is worth bearing in mind that normal programming doesn't require you to know where each flag is situated in the status register

The carry flag usually consists of the 9th bit of an arithmetic instruction For example if we add together 200 and 100 and get a number outside the normal range of the accumulator, ie 300 To get around this problem the most significant bit of this answer is stored in the carry flag and the rest is stored in the accumulator

The zero status simply tells us whether the last number dealt with by the processor was zero or not When we come to examine each instruction we'll see exactly how it is affected by each operation

The interrupt status tells us whether

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READ-OUT



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interrupts are enabled or disabled. If this bit is set it means that interrupts are disabled and if it is unset it means that interrupts are enabled.

The decimal mode status is set if decimal mode is in effect. In decimal mode all arithmetic operations are carried out using decimal arithmetic rather than binary arithmetic.

The break status is not normally used except for the interrupt handling software which has already been written for us in the shape of the OS. In brief, the 6502 jumps to the same address when it finds either a break instruction or gets an interrupt. This flag allows the computer to see which of these actions caused it to stop what it was doing.

The overflow status reflects the status of bit 6 of the last byte that we have used, while the sign status reflects the value of bit 7. If bit 7 is a 0, the number which is being tested is positive. If it is set, it means the number is negative.

Obviously you don't stand much chance of getting fluent in assembly language if you don't know the relevant instructions. The first instruction, in alphabetical order, is the *Adc* instruction. This mnemonic is intended to mean 'add with carry', which means add two numbers together taking into account the current setting of the carry bit. It works in eight addressing modes:

Immediate
Absolute (to a 16 bit address)
Zero Page (to address in zero page)
Pre-indexed with Index Register X
Post Indexed with Index Register Y
Zero Page Indexed with Index Register X
Absolute Indexed with Index Register X
Absolute Indexed with Index Register Y

Most of these addressing modes will become clearer as we progress. For the moment we can concern ourselves with the first two addressing modes.

What the *Adc* instruction does is to get the data from the address indicated, add it to the accumulator and then finally add in the contents of the carry flag. As we noted earlier, it copies the state of the imaginary 9th bit of the accumulator to the carry flag. The important point is that, because the carry flag is involved in both ends of the addition, we can add numbers that are larger than the actual size of the accumulator.

But what if we simply want to do a simple addition like finding out what 2 + 2 is? To demonstrate this, we'll have to introduce an instruction out of the proper order, which is the *Lda* instruction. It simply loads a number into the accumulator. So code to add two and two might be:

```
LDA £2
ADC £2
```

All this code does is to load the accumulator with 2, then add 2 to the 2 already in the accumulator. No it doesn't. It doesn't, because the carry flag is also taken into account. The only way to ensure the carry flag doesn't muck the sum up is to take steps to ensure it is unset before the sum is carried out. This calls for another new instruction, *Clc*, which clears the carry flag.

So, all we need to do is add a *Clc* instruction to the start of the above code. If you want to add larger numbers, you can do something like this:

1) Clear the carry flag
2) Add together the least significant bytes of the two numbers
3) Add the next bytes in ascending order
4) Repeat step 3 until all the bytes have been added

Using this technique, the carry flag will automatically take care of itself. The net effect is similar to the way some people add multi-digit decimal numbers, writing the carry digit as a small superscript to the original number.

We are not yet in a position to code the above method into assembly language, but several later programs in this book involve themselves with such additions. Particularly interesting from the point of view of arithmetic is the program for drawing straight lines using Bresenham's algorithm, which appears later in the book. ■

This is an extract from *The BBC Micro Compendium* available from 1 August from Interface Publications, 44-46 Earls Court Road, London W8 6EJ.

Open Forum is for you to publish your programs and ideas. Take care that the listings you send in are all bug-free. Your documentation should start with a general description of the program and what it does and then give some detail of how the program is constructed. We will pay the _Program of the Week_ double our new fee of £6 for each program published.

City Defence

on VIC20

Your mission is to defend the city from four jet bombers using your 22 missiles hidden beneath the metropolis in your rocket battery. You must use your missiles sparingly as liberal use lowers your skill rating.

However destroying a bomb in mid-air increases your rating dramatically. The idea of the game is to shoot down the four bombers before 1) they return to base 2) wipe out all the population or 3) land a bomb in your headquarters beneath the battery. If you are successful you will be given a report on your ability at defending the city. Warning: If a missile enters a silo it will destroy the missile it hits and disable the two either side.

Instructions

1 Type in program 1 then save it
2 Type in program 2 then save it
3 Load program 1, run it then new it
4 Load program 2 then run it
z — Moves the missile aimer left
c — Moves it right
b — Will launch a missile if it is there

Program notes

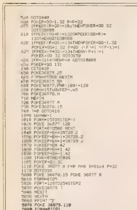
1-350	Setting up variables etc
350-520	Main body of the program (all subroutines stem from here)
600-640	Defines position and moves the bomb
650-740	Explosion routine when bombs hit something
1000-1120	Explosion routine for when an aircraft is hit
5000-5300	End report if successful
10000-10040	End report if unsuccessful
30000-30040	Routine to check if the bomb has hit anything

Generally the program relies on calling various subroutines from the main body of the program as it requires them.

```
1 REM*** CHARACTERS ***
2 REM
3 REM SAVE THIS PROGRAM
4 REM
5 REM BEFORE ENTERING
6 REM
7 REM THE SECOND ONE.
8 REM
9 REM
10 POKE51,255 POKE52,19
11 POKE55,255 POKE56,19
12 CLR
20 FORI=0TO2040
21 POKE5120+I,PEEK(32768+I)
22 NEXTI
30 FORI=0TO1024
31 READA
32 IFA=-1THEN200
33 POKE6144+I,A
34 NEXTI
100 DATA0,0,128 96,240,224,0 0
110 DATA0,0,3,252,255,255 60 0
120 DATA240,120,60,31,31,31,0,0
130 DATA0,0,0,24,28,14,7,3
140 DATA255,153,153,153 153 153,153,255
150 DATA0,144,152,152,153,153 153 255
160 DATA16,16 16,16,16,56,16,16,-1
200 POKE 36869 253
210 POKE 36866 PEEK(36866)OR128
```

```
1 POKE650,255
4 SK=0
5 DIMV(23
7 SC=5000
10 POKE 36879,8
20 PRINT"■ POKE36869,253
30 FORN=0TO21
40 POKE 7680+N 160
50 POKE 8164+N,160
60 POKE38884+N,(NAND7)
70 POKE38400+N,(NAND7)
80 NEXTN
85 POKE36869 240
90 PRINT"■■■■■■■■■■"
100 PRINT"■■■■■■ CITY GUARD
110 PRINT"■■■■■"
120 PRINT"■■■■■■■■V I C 2 0"
130 PRINT"■■■BY BENEDICT MACCARTY
135 PRINT"■■■WHAT LEVEL (0-10)
136 PRINT"■LEVEL 0 IS THE HARDEST"
137 INPUTY
150 PRINT"■" POKE36869,253
160 POKE 36879,59
170 DEFFNR(X)=INT(RND(1)*K)
180 FORA=0TO21
190 B=FNR(6)
200 POKE8142+A,102
210 POKE38662+A,5
220 FORH=0TOB
230 POKE 8120+A-H*22 132
240 POKE38640+A-H*22 0
250 NEXTH A
260 POKE 36878,15
270 FORN=0TO21
275 POKE 8164+N 134
276 PRINT"■■■■■■■■■■■■■■AIR ATTACK"
280 POKE 36876 1?5
290 FORL=0TO100 NEXT
295 PRINT"■■■■■■■■■■■■■■AIR ATTACK"
300 POKE 36876 0
310 FORL=0TO200 NEXTL N
320 PRINT"■■■■■■■■■■■■"
325 FORN=7680TO8009
326 POKEN+30720,7
327 NEXTN TI$="000000"
330 A=11 B=8164
340 HW=4 P=32
350 EH=FNR(15)*22+7680 EP=1
    IFEH=7680THEN350
360 POKEEH+EP 129 POKEEH+EP-1,130
    POKEEH+EP+1 128
370 IFEP+1=20THENPOKEEP+EH,32
    POKEEP+EH-1,32 POKEEP+EH+1,32
    GOTO350
380 Z=FNR(Y*10) IFZ=0THENJ=J+1
390 IFJ<1THENR=EH+22 QQ=EP J=J+1
400 IFJ>0THEN460
405 IFVAL(TI$)>500THENQW=QW+1 GOTO10000
410 GETA$
411 PRINT"■■■■■■■■■■■■"
412 PRINT"■■POPULATION="SC
413 POKE38884+A,1
420 IFA$="Z"ANDA>0THENA=A-1
430 IFA$="C"ANDA<21THENA=A+1
435 IFA$="B"THENM=M+1
437 IFM>0THEN460
440 POKE38884+A 2
442 POKEEP+EH-1 32
443 EP=EP+1 QQ=QQ+1
444 POKE 36878,15
450 GOTO360
460 K=K+1 IFK=1ANDV(A)=0THENXX=A
    V(XX)=1 GOTO470
465 IFB>8164ANDV(A)=1THENK=0 M=0 :
    P=32 GOTO440
470 POKE 36877 254
480 POKEXX+B P
490 B=B-22 P=PEEK(B+XX) IFB<7680THENK=0
    M=0 B=8164 P=32 POKE 36877 0 GOTO440
500 IFP=128ORP=129ORP=130THEN1000
505 IFP=131THENPOKE 36877,220 J=0 POKE
    EP+R,32 P=32 SK=SK+4 GOTO440 :
510 POKEXY+B 134
```

Continued over the page



```
520 GOTO440
600 POKER+QQ-1,32 R=R+22
605 IFPEEK(R+QQ)=102THENPOKER+QQ 32
    GOTO30000
610 IFPEEK(QQ+R)=132ORPEEK(QQ+R)=
    133THENGOTO30000
620 IFPEEK(R+QQ)=134THENPOKER+QQ-1,32
    POKER+QQ+1 32 F=QQ V(F)=1 V(F-1)=1
625 IFPEEK(R+QQ)=134THENV(F+1)=1
    POKER+QQ 32 GOTO650
626 IFR=2164THENR=0 GOTO10000
630 POKER+QQ 131
640 GOTO410
650 POKE36879 25
660 FORN=0TO600 NEXTN
670 POKE36879 50
680 POKE36877,FNR(100)+120
690 FORN=15TO0STEP-.05
700 POKE36878,N
710 NEXTN
720 POKE36877 0
730 POKE36878,15
740 I=0 GOTO410
1000 WW=WW-1
1010 FORN=15TO0STEP-1
1020 POKE 36877 120
1030 FORT=0TO500 NEXT
1040 POKEEP+EH+38720 2
1050 POKEEP+EH-1+38720,2
1060 POKEEP+EH+1+38720 2
1070 POKEEP+EH 42
1080 POKEEP+EH+1 42
1090 POKEEP+EH-1 42
1100 IFWW=0THEN5000
1105 POKER+Q 32
1110 POKE 36877 0 V=0 M=0 B=8164 P=32
1120 GOTO350
5000 POKE 36878,15 POKE 36877 0
5010 FORN=0TO5
5020 FORT=128TO254STEP2
5030 POKE36876 T
5040 NEXTT
5050 NEXTN
5060 PRINT"J"
5070 POKE 36879,110
5080 FORN=0TO21
5090 POKE 7680+N,160
5100 POKE 8164+N,160
5110 POKE 38400+N,(NAND3)
5120 POKE38884+N,(NAND3)
5130 NEXTN
5140 PRINT"YOU HAVE SUCCESSFULLY
5150 PRINT"DESTROYED 4 ENEMY
5160 PRINT"AIRCRAFT."
5170 FORN=0TO21
5180 IFV(N)=0THENSK=SK+1
5190 NEXTN
5200 PRINT"YOU SAVED THE LIVES OF"
5210 PRINT" SC PEOPLE,BUT "5000-SC
5220 PRINT"WERE KILLED"
5230 R=INT((SK/302)/1.3)
5240 PRINT"SKILL RATING="R"/10"
5250 PRINT"ON LEVEL"Y
5300 END
10000 PRINT"J" POKE 36878,15 POKE36877,0
10001 FORN=0TO5 FORT=254TO128STEP-1
10002 POKE 36875,T NEXTT,N
10003 POKE 36875,0 POKE 36878,0
10004 FORN=0TO21 POKE7680+N 160
      POKE8164+N,160 POKE38400+N,
      (NAND7) POKE38884+N,(NAND7)
10005 NEXTN
10010 PRINT"YOU FAILED THE"
10020 PRINT"CITY HAS BEEN "
10030 PRINT"DESTROYED!"
10035 IFQQ=1THENPRINT"THE BOMBERS
      RETURNED" PRINT"TO BASE."
10040 END
30000 FORN=0TO7
30010 IFPEEK(QQ+R-N*22)=132ORPEEK
      (QQ+R-N*22)=133THENPOKEQQ+R-
      N*22 32
30020 NEXTN
30025 IFPEEK(QQ+R+22)=132THENPOKEQQ
      +R+22 32 IFPEEK(QQ+R+44)=132THEN
      POKEQQ+R+44 133
30030 SC=SC-FNR(500) IFSC=<0THEN10000
30040 GOTO650
```

City Defence
by B MacCafty

Symmetry

on BBC Micro

This program enables the user to create almost any symmetrical pattern or shape that he or she wishes

These patterns range from simple hexagons or pentagons to the most complicated star shapes or ellipses

Program notes

10 Set mode (for use with a model A change this to MODE 4)

40 Asks for the length of each step (degrees) and the initial values of X and Y

50 Asks for the amount to be taken away from X and Y and each step Try 80 400 400 1)

60 Moves graphics cursor to the starting point

80 Draws the shape step by step

100 If the values inputed in line 50 are both 0 and the space bar is pressed you are given the option to repeat the pattern If the values <>0 and the space bar is pressed the screen will clear and the program reruns

110 If E is pressed the program ends leaving the pattern on the screen

130 Prints repeat option on the screen

140 Determines the answer from the previous line and acts accordingly

Variables used

Length — Determines the length of the program
B — Length of each step
C — X radius
D — Y radius
E — The amount taken away from C after each step
F — The amount taken away from D after each step
PS A very nice effect is obtained by 256 400 400 5 5

```
10 MODE 0
20 *KEY 0 RUN|M
30 Length=0
40 INPUT"Length of each step "B:INPUT"  X radius "C:INPUT"  Y radius "D
50 INPUT"X=X-"E:INPUT"Y=Y-"F
60 MOVE 640+C*SIN(RAD(Length)),512+D*COS(RAD(Length))
70 FOR Length=0 TO 9999999 STEP B
80 DRAW 640+C*SIN(RAD(Length)),512+D*COS(RAD(Length))
90 C=C-E:D=D-F
100 A$=INKEY$(0):IF A$=" " AND E=0 AND F=0 GOTO 130:ELSE IF A$=" " RUN
110 IF A$="E" END
120 NEXT Length
130 PRINT"REPEAT (Y/N) ":A$=GET$
140 IF A$="Y" CLS:Length=0:GOTO 70 ELSE RUN
```

Symmetry
by N Butler

3-D Plot

on Dragon 32

The program listed below draws a three dimensional plot on the Dragon 32 It could easily be converted to run on nearly any other computer by changing lines 50 150 160 260 270 340 — 360 The two commands it makes most use of are the *Poke* & HFFD7 0 and the *Csavem* command Make sure the Dragon version you have can handle this *Poke*

Once typed in run for a few minutes then stop it and set up a tape recorder to record (make sure you have a high quality tape inserted)

Then run it — the plotting should take about 1½ hours, without the speed command it will take about three hours Once run and automatically saved on tape it should take about 30 seconds to load with a *Cloadm* command

Program notes

10 50	*Rem* and clear screen
70	Defined formula
80-140	Asign constants to variables
150	Set up graphics screen
160	Speed up processor
170-220	Formula functions
230	Call sub routine
260	Slow down processor (to enable to be saved on tape)
270	Machine code routine
290-320	Use of formula functions for plot command
340-350	Plot commands
360	Return to 280 to end or hold on screen

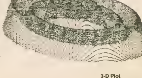
Now try changing line 70 from SIN to COS This is an excellent chance to see the Dragon high resolution capabilities with a graph that you may only see on a main frame computer

PROGRAM OF THE WEEK

```
10  REM  ************************
20  REM  **3D-PLOT NOV.1982.6.***
30  REM  ****SHAUN WILLMOTT.*****
40  REM  ************************
50 CLS
60  PRINT : PRINT : PRINT
70  DEF  FN R(Q) =  SIN (Q) +  SIN (2 * Q) +  SIN (5 * Q)
80 A = 144
90 B = 2.25
100 C = 20
110 D = 0.0327
120 E = 160
130 F = 90
140 G = 199
150 PMODE4,1:SCREEN1,0:PCLS
160  PUKE 65495,0
170  FOR H =  - A TO A STEP B
180 AA =  INT (0.5 +  SQR (H * A - H * H))
190  FOR BB =  - AA TO AA
200 CC =  SQR (BB * BB + H * H) * D
210 D1 =  FN R(CC)
220 DD = D1 * C
230  GOSUB 290
240  NEXT BB
250  NEXT H
260  POKE 65494,0
270 C SAVE M"FILE NAME",1536,9216,7680
280  END  REM  ** OF GOTO 280 TO HOLD
290 X = BB + (H / B) + E
300 Y = DD - (H / B) + F
310 X1 =  INT (0.85 * X)
320 Y1 =  INT (0.9 * (G - Y))
330  IF Y1 < 0 OR Y1 > 190 THEN  RETURN
340 PSET(X1,Y1)
350 PRESET(X1,Y1 + 1)
360  RETURN
```

```
LIST

10  REM  ***********************
20  REM  *** RETRIEVE PLOT ****
30  REM  **********************
40 PMODE4,1:SCREEN1,0:PCLS
50 F CLEAF 3
60 C LOAD M"FILE NAME"
70  GOTO 70
```



3-D Plot
by Shaun Willmott

Squares

on Spectrum

This is my version of the good old pen and paper game called Squares in which two players take it in turn to draw a line on a grid of dots and try to make a 1x1 box and put their initial in it

The winner is the person with the most boxes when there is no more space to draw lines (ie when it is a grid of lines). After a player has completed a box he/she gets another go. Full instructions are contained within the program

Program notes

50-200 Main part of prog
2000-2040 Make sure move is valid
6000-6030 End of game routine
8000-8320 Put initial of player into box
9000-9971 Instructions and set up screen

Variables

D$ — players move horizontal (1) vertical (1) x-coord (2) y-coords (3)
p$ — play 1 s initial (1)
p$ — player 2 s initial (2)
PL1S — player 1 s score
PL2S — player 2 s score
X, Y — pixel co-ords (x y)
pl — current player

```
   1 REM ****** SQUARES ******
   2 REM *** (C) M J SHELLE ***
   3 REM ********1.6.83********
   4 GO SUB 9900: REM INSTRUCTIO
NS
   5 POKE 23658,8
   6 GO SUB 9000: REM SCREEN
   9 REM PRINT UP CURRENT PLAYER
  10 IF pl1s+pl2s=49 THEN GO TO
6000
  15 IF pl=1 THEN LET pl=2: GO T
O 30
  20 IF pl=2 THEN LET pl=1
  30 PRINT AT 15,20; PAPER pl+4;
INK 9;"PLAYER ";pl
  40 PRINT AT 6,20; PAPER 0; INK
 4;"SCORES";AT 10,20; INK 5;"
Player 1 ";pl1s;AT 12,20; INK 6
;"Player 2 ";pl2s
  44 REM ERASE COMMENTS
  45 PRINT AT 18,19;"       ";
AT 19,19;"      "
  49 REM MAIN PART OF PROG.
  50 DIM D$(3): POKE 23560,0: IN
PUT "DIRECTION , COORDS ";LINE D
$
  55 IF d$(1)<>"V" AND d$(1)<>"H
" THEN GO TO 50
  58 GO SUB 2000
  60 IF d$(1)="H" THEN GO TO 200
  90 IF D$(3)>7 THEN PRINT AT 1
8,19; FLASH 1;"Y-TOO HIGH": BEE
P .1,0: GO TO 50
 100 PLOT x,y: DRAW 0,16: BEEP .
1,20
 105 REM SEE IF SQUARE HAS BEEN
COMPLETED
 110 LET N=0: IF (POINT (x-8,y)=
1 AND POINT (X-16,y+8)=1 AND POI
NT (x-8,y+16)=1) THEN GO SUB 800
0: LET N=1
 120 IF (POINT (x+8,y)=1 AND POI
NT (x+16,y+8)=1 AND POINT (x+8,y
+16)=1) THEN GO SUB 8050: LET N=
1
 130 IF N=1 THEN GO SUB 3000
 140 GO TO 10
 200 IF D$(2)>7 THEN PRINT AT
18,19; FLASH 1;"X-TOO HIGH": BEE
P .1,0: GO TO 50
 205 PLOT x,y: DRAW 16,0: BEEP .
1,20
 206 REM SEE IF SQUARE HAS BEEN
COMPLETED
 210 LET N=0: IF (POINT (x,y+8)=
1 AND POINT (X+8,y+16)=1 AND POI
NT (x+16,y+8)=1) THEN GO SUB 810
0: LET N=1
 220 IF (POINT (x,y-8)=1 AND POI
NT (x+8,y-16)=1 AND POINT (x+16,
y-8)=1) THEN GO SUB 8200: LET N=
1
 225 IF N=1 THEN GO SUB 3000
 230 GO TO 10
1990 REM VALIDIFY MOVE
2000 IF D$(2)>8 OR D$(2)<1 THEN
 PRINT AT 18,19; FLASH 1;"X-T
OO HIGH": GO TO 50
2010 IF D$(3)>8 OR D$(3)<1 THEN
 PRINT AT 18,19; FLASH 1;"Y-T
OO HIGH": GO TO 50
2020 LET x=VAL D$(2)*16+10: LET
y=VAL D$(3)*16+2
2030 IF (POINT (x,y+8)=1 AND D$(
3)<>"8" AND d$(1)="V") OR (POINT
 (x+8,y)=1 AND D$(2)<>"8" AND d$(
1)="H") THEN PRINT AT 18,19; FL
ASH 1;"already taken";AT 19,19;
"try again": GO TO 50
2040 RETURN
3000 IF pl=1 THEN LET pl=2: GO T
O 3020
3010 IF pl=2 THEN LET pl=1
3020 RETURN
6000 FOR n=1 TO 4: FOR a=10 TO 3
0 STEP 5: BEEP .01,a: NEXT a: NE
XT n
6010 IF pl1s>pl2s THEN PRINT AT
15,19; FLASH 1; INK 3; PAPER 7;"
PLAYER 1 WON"
6011 IF pl2s>pl1s THEN PRINT AT
15,19; FLASH 1; INK 3; PAPER 7;"
PLAYER 2 WON"
6012 IF pl2s=pl1s THEN PRINT AT
15,20; FLASH 1; INK 3; PAPER 7;"
 DRAW"
6015 PRINT AT 21,2; PAPER 5; INK
 0; FLASH 1;"PRESS ANY KEY TO PL
AY AGAIN"
6020 BEEP .1,RND*50: IF INKEY$<>
"" THEN CLS : GO TO 5
6030 GO TO 6020
8000 PRINT AT 21-(y+8)/8,(x-10)/
8; INK pl+4;p$(pl): LET pl1s=pl1
s+(pl=1): LET pl2s=pl2s+(pl=2)
8010 GO TO 8300
8050 PRINT AT 21-(y+6)/8,(x+8)/8
; INK pl+4;p$(pl): LET pl1s=pl1s
+(pl=1): LET pl2s=pl2s+(pl=2)
8060 GO TO 8300
8100 PRINT AT 21-(y+6)/8,(x+8)/8
; INK pl+4;p$(pl): LET pl1s=pl1s
+(pl=1): LET pl2s=pl2s+(pl=2)
8160 GO TO 8300
8200 PRINT AT 21-(y-8)/8,(x+6)/8
; INK pl+4;p$(pl): LET pl1s=pl1s
+(pl=1): LET pl2s=pl2s+(pl=2)
8210 GO TO 8300
8300 FOR n=1 TO 3: FOR a=10 TO 5
0 STEP 5: BEEP .01,a: NEXT a: NE
XT n
8320 RETURN
8330 STOP
9000 DIM p$(2): INPUT "PLAYER ON
E S [redacted] INITIAL ",p$(1)
9001 INPUT "PLAYER TWO S [redacted]
INITIAL ",p$(2)
9002 LET pl1s=0: LET pl2s=0
9005 FOR n=26 TO 130 STEP 16: FO
R a=18 TO 130 STEP 16: BEEP .01,
a/2-20: PLOT INK 7; BRIGHT 1;n,a
: NEXT a: NEXT n
9010 FOR n=2 TO 10 STEP 2: PRINT
 AT 21-n,1; PAPER (n/2)-1; INK 9
;n/2: PRINT AT 3,n+1; PAPER (n/2
)-1; INK 9;n/2: BEEP .01,n+8
9020 NEXT n: PRINT AT 3,19; INVE
RSE 1;"X";AT 9,1;"Y"
9030 INK 4: PLOT 10,10: DRAW 0,1
20: BEEP .1,10: DRAW 120,0: BEEP
 .1,20: DRAW 0,-120: BEEP .1,30:
 DRAW -120,0: BEEP .1,40
9040 PRINT AT 0,0; INK 3;"Horiz
ontal lines will be drawn to the
 right of selected point";AT 2,2
1;"Vertical";AT 3,21;"ones drawn
";AT 4,21;"up from the";AT 5,21;
"point"
9049 LET pl=2
9050 RETURN
9900 PAPER 0: INK 7: BORDER 0: C
LS : BRIGHT 1: PAPER 1
9910 PRINT AT 0,12; FLASH 1;"SQU
ARES": FLASH 0;"The idea of th
is game, for two players, is
 for each to complete
 as many squares as possible"
9920 BEEP 1,-10: PAUSE 100: PRIN
T "Each player takes it in tur
n to draw either a vertica
l or horizontal line."
9925 BEEP 1,5: PAUSE 100: PRINT
"If you complete a box you wil
l score a point and get an extr
a go."
9930 BEEP 1,10: PAUSE 100: PRINT
"At the begining of the game
 you will be asked to enter t
he SINGLE initials of each play
er, if you enter more than one l
etter only the first will be
 displayed in the boxes."
9940 BEEP 1,26: PAUSE 100: PRINT
 AT 21,3; PAPER 0; INK 7;"PRESS
ANY KEY TO CONTINUE": PAUSE 0: P
APER 0: CLS : PAPER 1
9945 PRINT AT 0,12; FLASH 1;"SQU
ARES"
9950 PRINT "When asked for 'D
IRECTION + COORDS' you type
in something like V43 meaning
 a vertical line going upwards
 from point (4,3) if you wanted
 a horizon- tal line you would
type in something like H43"
9960 BEEP 1,35: PAUSE 100: PRINT
 "The game ends when there is
no more space for lines to be
 drawn."
9970 BEEP 1,45: PAUSE 100: PRINT
 AT 14,4; FLASH 1;"PRESS ANY KEY
 TO START"
9971 PAUSE 0: PAPER 0: INK 4: CL
S : RETURN
```

Squares
by Mark Shelley



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Key bleep

on Dragon 32

This simple machine code routine is based on Peter Chase s article on sound in one of the earlier editions of *PCW* The keys when pressed make the computer jump to the address which holds the machine code routine This is done by Poking the start address of this routine into addresses 363 & 364

It enables the Dragon to produce a different pitch of note for each key pressed by the ueer This is done by loading the address &HFF23 with the value of address &H0151 To enable the key bleep *Poke* 362 126 To disable the key bleep *Poke* 362, 57

```
10 REM******************************
20 REM*  KEY BEEP ROUTINE FOR       *
30 REM*         DRAGON 32           *
40 REM*   (C)COPYRIGHT 1983 BY      *
50 REM*   NICHOLAS     EDMUNDS      *
60 REM******************************
70 REM CLEAR MEM SPACE
80 CLEAR 200,&H7FD5
90 REM  SET INTERUPT DEST
100 POKE 363,&H7F:POKE 364,&HD5
105 For x = &H7FD5 To &H 7FFE
110 POKE X,VAL("&H"+A$)
120 NEXT X
130 REM DATA FOR SOUND REGESTERS
140 REM****************************
150 DATA 06,FF,23,8A,08,B7,FF,23,B6,FF,01,84,F7,B7,FF,01,B6,FF,
    03,84,F7,B7,FF,03
160 REM DATA FOR MAIN ROUTINE
170 REM****************************
180 DATA C6,FF,B6,FF,20,BB,01,51,B7,FF,20,5A,C1,00,26,F2,39,39
190 END
```

Key Bleep
by Nicholas Edmunds

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Velnor's Lair

I have a number of queries from frustrated adventurers this week The first plea I received was from M Bannon of Liverpool

Can you help me? I am at the point of suicide I feel like flushing Thorin down the loo I have managed to complete 65 percent of the adventure but I cannot get any further

"I have succeeded in acquiring the treasure and killing the dragon However I cannot return I have tried to go through the empty place but it is too full to enter I have tried to get past the pale bulbous eyes on the Forest Road — no luck I have even tried to get captured by the wood elf again and so pass through the magic door, but the damn thing won t open!

"PS I would be extremely grateful if you could reply to this letter in any way shape or form before I finish making the noose"

Well not to put too fine a point upon it, you are almost there I would discard two of your options and concentrate on the third And please please, do not flush Thorin down the loo — I don t think he would appreciate it.

Eric Cook from Manchester has succeeded in opening the ultimate gate of pi but is having problems passing through it Can anyone help?

Eric also has this advice for anyone playing Artic's adventure C 'Be careful how you point your sonic screwdriver' is this a clue?

And now Andrew Pennell has kindly provided the following review of Quicksilva s Velnor s Lair

The idea of this adventure for the 48K Spectrum is to stop Velnor the Black Wizard from spreading evil across the world To fulfil this heroic task you must venture into the golden labyrinth and, as either a warrior a priest or a wizard you must seek out Velnor and destroy him before it is too late However to hinder you the labyrinth is full of a large number of nasty creatures who are under Velnor s control and will try to stop you

Although the program is written in Basic it has a good vocabulary and a very fast response time It is a text-only adventure with some colour and a little sound The program almost fills the Spectrum and an examination of the listing reveals that all the space saving techniques 1K ZX81 users are familiar with are used to cram more into the 40K available Strangely, the most fundamental adventure verb *Get*, is not recognised — the word *Take* replacing it — which takes a little getting used to

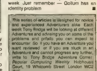
Drawing a map as you play is strongly recommended and straightforward, unlike *The Hobbit* where owing presumably to Wilderland geometry map-drawing is near impossible

There are a good number of useful (and not so useful) objects scattered around the labyrinth and examining them can prove very useful indeed There are also several secret passages and sections where a lot of thought is needed to pass through There are also some unpleasant things wandering about and they are often in unrealistic quantities — quite early in the game it is possible to walk into the Ogres kitchen, whereupon no less than four ogres attack you Escape is seldom possible!

When you are in combat with any monsters, you can either be brave and fight (or use a spell), or you can be a coward and try to run away It is also possible and necessary to save a game on tape to continue playing at a later date

Velnor s Lair written by Derek Brewster can be thoroughly recommended for all adventurous Spectrum owners

Well that about wraps it up for this week Just remember — Gollum has an identity problem ■


This series of articles is designed for novice and experienced Adventurers alike Each week Tony Bridge will be looking at different Adventures and advising you on some of the problems and pitfalls you can expect to encounter So if you have an Adventure you want reviewed or if you are stuck in an Adventure and cannot progress any further, write to Tony Bridge Adventure Corner *Popular Computing Weekly* Hobhouse Court, 19 Whitcomb Street London WC2 7HF

Cruising & Blind Alley

£10 to be won

Can you beat the new high score?

Cruising

First there was *Space Invaders* then there was *Pacman* – now there is *Cruising* This all action machine code, arcade type game will test your powers of co-ordination to the limit Never before has a game asked you to think so quickly or move so fast

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Popular Computing Weekly is offering £10 each month to the player with the highest score on *Cruising* All you have to do to enter this month s competition is send a print out of your highest score together with your name and address to

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Cruising
Hobhouse Court
19 Whitcomb Street
London WC2 7HF

Each month we will publish the name of the winner and the new *Cruising* high score Are you good enough to accept the *Cruising* challenge?

The winner of last month s competition with a score of 43552 was Carl Doran of Skidby Mill N Humberside Entries for this month s competition close on August 31

Notes

1) Each entry must consist of a ZX printout and your name and address
2) Closing date for this month s *Cruising* challenge entries is August 31
3) The highest score each month will receive £10
4) High scores cannot be transferred from one month to another
5) The judges decision is final
6) No employees of Sunshine Publications Ltd or their families will be eligible to enter

Blind Alley

Blind Alley is a game of strategy In order to win you must outwit the computer using your craft to fence in and finally destroy the enemy pursuit vehicles But watch out for the solid trail left by your opponents — one touch is fatal!

Each month *Popular Computing Weekly* is giving away £10 to the player with the highest score on *Blind Alley* To enter this month s competition simply send in a copy of your score and the code at the bottom of the score table together with your name and address to

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The winner of last month s competition with a score of 99855 was Shui Chung Li of Birmingham Entries for this month s competition close on August 31



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BLANK SPACE

Mick Levy of Christchurch Hampshire writes

Q **I am not sure whether it is my ignorance of my new toy, (a Spectrum 48K), or whether there is something wrong with it. My problem concerns *Screens* and my using a blank space, such as *Chr$* 20 or *Chr$* 143. I am writing a sort of Pacman, but when I come to try to detect a collision with a wall, the computer seems to think everything is a space.**

A You have come up against one of the quirks in the Spectrum ROM That is that *Screen$* is not all it should be Not all characters are affected, and you might try something like an inverse capital X for your walls It is just a case, I am afraid, of trying out the various characters, to find one that suits the overall look of the program

ATARI SOUNDS

P A Bainbridge St Georges Hill Weybridge writes

Q **Like a lot of people, I am thinking about buying a home computer One of the things that will influence my choice is the range of sound commands on the various home computers. I have managed to get some information about most of the sound commands, with the exception of Atari. Can you give me any details on how loud it is and how versatile?**

A The Atari sound command uses the television loudspeaker so it is capable of louder noises than most of its counterparts If you are particularly interested in sound then you will find the four parameters that go to make up the sound command quite flexible The parameters are *Channel Tone Distortion* and *Volume*

Channel is a number from 0 to 3 which selects the channel you want to use *Tone* is a value between 0 and 255 *Distortion* has seven values — 10 is normal and the rest are special effects *Volume* is obvious You do not have to enter the name of each parameter instead a sound command takes a form such as

```
SOUND 2 150 10 9
```

Thus on channel two we have a tone of 150 (the higher the number the lower the tone) The sound is pure rather than a "special effect" and the volume is 9 (maximum 15 the higher the number the louder the note)

STRING HANDLER

David Murphey of Liverpool writes

Q **I am getting on quite well with my new Spectrum (48k), but it will be a long time before I have learned enough to really get to grips with machine code Until then can you suggest a compiler for the Spectrum, preferably one that can handle strings?**

A There are currently two compilers available for the Spectrum One by Softek (*PCW* 26 May—1 June) and the other by PSS The new version of the PSS *Mcoder* can handle strings — there is also an *Mcoder 2* for the ZX81, which can also handle strings

The *Mcoder* for the Spectrum costs £9 95 and £8 95 for the ZX81 version, PSS's address is
452 Stoney Stanton Road
Coventry CV6 5DG

FLIGHT PATH

N Webber of Railway Road Teddington Middlesex writes

Q **I have a BBC B and am interested in purchasing a Flight Simulator, but one does not seem to be available Could you advise me if one is available, and, if so, is it worth getting?**

Secondly, is there a way I can change colour of the cursor? I have tried using *V6 Vdu 19,1,2,0,0,0* but this only leaves a white cursor and a green text on a black background

A There are two Flight Simulators as far as I know for the BBC — as I have not seen either of them Running, I cannot say what they are like

One written by a former pilot, is available through Doctor Soft and is the BBC version of a successful Atom original The other is by DACC — the Dragon version of this program has received good reports Addresses are
Doctor Soft
258 Coneygree Road,
Stanground
Peterborough PE2 8LR
DACC
23 Waverley Road
Hindley,
Greater Manchester WN2 3BN

As for trying to change the colour of the cursor I am afraid that you are limited to the inverse of the background colour

MISSILE COMMAND

Tim Yates of Swindon Lane, Cheltenham writes

Q **I have meant to write this letter for some time In the June 3 issue of *Popular Computing Weekly* there is a review of Hi-Tech's highly acclaimed *Missile Command* for the Vic20 with 3K expansion My local shop does not stock Hi Tech software Could you give me their address, so I can send for a copy of *Missile Command*?**

A This certainly had me rummaging amidst the back issues The address I have for them is
Hi Tech
Freepost
Dover
Kent

The company seems to be concentrating on programs for the Jupiter Ace at the moment, so I would suggest that you contact them first before sending any money

LYNX USERS

Jerry Morgan of Holbeck Leeds writes

Q **I seem to be one of the few people who have bought a Lynx and, though I am a newcomer to computing, I am very happy with it I would like to know whether or not I am in complete isolation, so could you tell me if there is actually a user group for this computer?**

A Yes there is a user group for the Lynx, though it is quite new It is NILUG (National Independent Lynx User Group) It publishes a magazine — NILUG NEWS — that is planned to come out six times a year (issue one is out now) The subscription is £9 00 For further details contact
NILUG
53 Kingswood Avenue,
Sanderstead
South Croydon
Surrey CR2 9DQ

Stop! I have had several letters already pointing out my none too subtle error in my answer to J Tennant (*PCW* June 30—July 6)

Having sat down at the typewriter confident in the knowledge that the Vic had an input buffer of 4 screen lines I then proceeded through some unguessable mathematical aberration to work that out as 255 bytes! Not 88! It was also pointed out by a couple of people that tokenised line commands were useful when it comes to saving space and on reflection this would have been a better angle to approach this question from

Apologies I just hope that no one has returned their Vic after failing to have a line half a screen long accepted I cannot even come up with a good excuse I'm afraid Well the weather was hot The editor should have spotted it

Is there anything about your computer you don't understand, and which everyone else seems to take for granted? Whatever your problem *Peek* it to Ian Beardsmore and every week he will *Poke* back as many answers as he can. The address is *Peek & Poke*, *PCW*, Hobhouse Court, 19 Whitcomb Street, London WC2 7HF.

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Wanted

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16K SPECTRUM WANTED Around £50 Tel Harpenden 69152
WANTED Tandy PC 2 or Sharp PC 1500 pocket computer with or without accessories or software Tel Amesbury 23214

NEW RELEASES

NUDGE!

It is certainly true that the Colour Genie has never been mentioned on these pages before mainly because nobody has sent me any Colour Genie material — until now

Chewing Gum is the title of the Colour Genie Users Magazine which is free to everyone who belongs to the NCG users group

The group also features its own software among which is *Frutee Nudge* — a version of fruit machine complete with music hold and nudge etc It will also work with joysticks

Program *Frutee Nudge*
Price *£5*
Micro *Colour Genie*
Supplier *National Colour Genie Users Group*
46 Highbury Avenue
Bulwell
Nottingham NG6 9DB

BUNKER

Gem Software has released three new games for the Lynx Two are games packs the third is *Golf*

Golf offers you a choice of handicap club, etc and even asks you your golfing weaknesses There are various obstacles along the way including the inevitable bunker

Program *Golf*
Price *£7 95*
Micro *Lynx 48K*
Supplier *Gem Software*
Unit D The Maltings
Station Road
Sawbridgeworth
Herts

RUN-OUT

Now that summer is here the thoughts of many a young man turn to that most noble and civilised of all sports — cricket

Lazy sweltering days the gentle rustle of pristine whites the blip of bat against ball, the dot crawl on the screen — Yes folks now you can play cricket on your computer! No need to go out in the sun! Save money — no special equipment needed!

Well you will need a Spectrum with 48K *Cricket* from KMC programs has all the real life features, eg batsmen can be bowled stumped, lbw caught or run-out — when dismissed they will grumpily walk off the field There is even a 'rain stops play' routine in which spectators are shown standing huddled under their umbrellas

Program *Cricket*
Price *£4 95*
Micro *Spectrum 48K*
Supplier *K M Cooksey*
97 Catharine Street
Cambridge

DESIGNER

Easy Graphics is a new graphics designer program for the BBC micro The program uses a moving cursor to draw and erase lines in all *Plot* modes

Several geometric shapes can be constructed and any shape can be filled You can freely mix text and hi-res and save your design on tape to reincorporate back into your own programs

The tape includes a demonstration program and full instructions on how to use it

Program *Easy Graphics*
Price *£13.50*
Micro *BBC 32K*
Supplier *Hexagon Software*
17 Shaws Road
Gornal Dudley
West Midlands
DY3 2UR

CARDS

Gamblers may be interested in a new tape from Leroysoft

It has issued two popular card games on one tape *Solitaire* and *Higher n Lower* Both games are preceded by extensive instructions on how to play the game

Program *Solitaire*
Price *£3 75*
Micro *Spectrum 16/48K*
Supplier *Leroysoft*
10 Silver Walk
Nuneaton
Warwickshire
CV10 7LY

ADDICTIVE

Star Soccer is a program that has been available for a while on the ZX81 Now it is available on the Spectrum

The game graphically displays the action of a football match, with sound effects at appropriate moments

The manufacturer claims it is incredibly addictive and quite different from *Football Manager*

Program *Star Soccer*
Price *£5 95*
Micro *Spectrum 16K*
Supplier *Watson Software Services*
1 Ivy Cottages
Long Road West
Dedham
Essex CO7 6EL

NOT CHEAP

Owners of the 48K Oric who are miffed at being excluded from the Forth language deal, offered to those who bought their machines mail order will be able to get the package after all — at a price

Oric *Forth* is a cassette and 75 page manual All the sound channels and high resolution graphics are available in this version of the language

At £17 95 it is more expensive than comparable programs for the Spectrum, but the manual is much more extensive than those usually supplied and is actually intended to explain Forth rather than merely outline the commands available

Program *Forth*
Price *£17 95*
Micro *Oric 48K*
Supplier *Tansoft*
3 Club Mews
Ely Cambs CB7 4UN

FLIP TOP!

Hot on the heels of *Jumping Jack* Imagine has released two more games for the Spectrum — *Zip Zap* and *ZZoom*

Both games are for the 48K machine and are the first to be featured in Imagine's new flip-top boxes

ZZoom gives you the task of defending a group of refugees from attack You have a ground skimmer equipped with the usual weapons and must do battle over land sea and desert

The screen displays a view from the cockpit — the enemy machines appear in the distance as specks which suddenly rush towards you in glorious 3D

Program *ZZoom*
Price *£5 50*
Micro *Spectrum 48K*
Supplier *Imagine Software*
Masons Buildings
Exchange St East
Liverpool L2 3PN

WILD WEST

Vortex's *Android 1* was well received by the computer press and the company has now issued its next program This is not, however, *Android 2* but *Gun Law*

Gun Law as the name suggests is set in the old west Your task is to clean up the town by killing all the baddies who lurk there But this is complicated by the innocent bystanders — citizens who could easily be mistaken for outlaws, you must try not to kill them

Program *Gun Law*
Price *£5 95*
Micro *Spectrum 16/48K*
Supplier *Vortex Software*
26 Crawford Road
Hatfield
Herts AL10 0PG

CODED

If you want to learn morse code you can use your computer with *Morse Tutor* from ABC Software

The program will translate words into morse, and vice versa and requires a Vic20 plus an additional 3K of memory

Program *Morse Tutor*
Price *£4 50*
Micro *Vic20 + 3K*
Supplier *ABC Software*
99 Church Street
Stapleford
Notts
NG9 8GF

ILLUSION

If you thought that *Zen* was a metaphysical belief that all is illusion, you d be right — but have you ever stopped to consider that it is also the name of a highly respected Editor/Assembler now available for the Newbrain? Ah! I thought not

Kuma Computers is selling a package consisting of *Zen* a manual and a full assembly listing — although they stress that you will also need a good Z80 programming book

Features of *Zen* include a full object code debugger six maths operators and a full set of editor commands

Program *Zen*
Price *£29 50*
Micro *Newbrain*
Supplier *Kuma Computers*
11 York Road
Maidenhead
Berkshire

REPLAY

Quazar Computing seems to be one of the few companies issuing programs for the Lynx

Othello is a version of the board game written in machine code with three play levels a game replay option and a demonstration game to get you started

Program *Othello*
Price *£4 75*
Micro *Lynx*
Supplier *Quazar Computing*
17 Teg Close
Portslade
East Sussex
BN4 2GZ

INSANITY

Bug-Byte has been very quiet over the past few months setting up its own tape duplication plant and moving offices But now it has returned to the fray with seven new releases

The star of the batch seems to be *Manic Miner* As miner Willy you stumble upon a forgotten mine shaft and a series of caverns dug by crazed automatic robots Willy must pass from cavern to cavern by collecting a series of keys — his ultimate destination a huge stockpile of valuable minerals

However there is danger in the form of the robots and crumbling supports It all sounds fairly standard game type stuff but all of the caves contain various extra nasties the natures of which have little to do with the plot and more to do with incipient insanity These nasties include plunging telephones bouncing kangaroos, and most worryingly of all malevolent toilets

Undoubtedly one of the best Spectrum releases this year and one of the few that may trouble Ultimate Play The Game

Program *Manic Miner*
Price *£5 95*
Micro *Spectrum 48K*
Supplier *Bug Byte Software*
Mulberry House
Canning Place
Liverpool L1 8JB

FASTER!

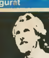
A new company offering machine code games on the Dragon has to be good news

Hornet is the company and its first two releases are *Wormtube* and *Mission Empire*

Wormtube features a tube down which you must guide your ship as it travels faster than light While keeping clear of the sides of the tube, you must also avoid rocks and collect pieces of gold

Program *Wormtube*
Price *£8*
Micro *Dragon 32*
Supplier *Hornet Software*
10 Buckingham s Way
Sharnford
Leics
LE10 3PX

New Releases is designed to let people know what software is coming on to the market If you have a new game or utility which you are about to release send a copy and accompanying details to New Releases Popular Computing Weekly 19 Whitcomb Street London WC2 7HF



Another language for the BBC

Acorn will shortly announce another language Rom for the BBC machine — BCPL.

In fact many of the more sophisticated ideas in BBC Basic came from the language. For example — *indirection operators*. Users of the BBC machine will have noticed the section in the user guide on their use. In BBC Basic there are three indirection operators: ? (the query), ! (the pling) and $ (the dollar).

The idea of these operators derives directly from the BCPL language. BCPL, developed by the University of Cambridge, was originally designed as a compiler writer language. The initials come from the fact that, to start off with, it was called Basic Combined Programming Language. BCPL was itself a development of CPL — developed jointly by the universities of Cambridge and London — a language with a long history in British computing.

BCPL has a very simple structure and was one of the first languages to use the concept of an idealised machine. In the standard book on the language (*BCPL: The Language and Its Compiler*) the authors M Richards and C Whitby Stevens use this concept. The idealised machine has a 'store' — a set of numbered storage cells arranged so that the numbers labelling adjacent cells differ by one.

A cell contains a pattern of bits (anywhere between 4 and 32 bits — depending on the actual computer) and the pattern of bits is called a 'value'.

A variable is a name which is associated with a storage cell and has a varying value depending on the bit pattern. Almost all forms of definition in BCPL use variables.

In BCPL there is only one way in which the value corresponding to a variable is stored. Many other languages (eg most Basics) store real numbers, integer numbers and string variables.

In BCPL, as with Forth, there is only one way to store a value (ie a pattern of bits) and the interpretation of the meaning of the value is left to the programmer.

A BCPL program consists of one or more procedure declarations (as with many other languages), and one of the procedures must be called *Start* — program execution commences by calling *Start*. An example might be

```
LET START () BE WRITES ( Ziggie RAT )
```

where *Start* is a parameterless procedure, as is shown by (). Another example is

```
LET START () BE $( LET A,B,C,SUM = 1,2,3 0
    SUM := A+B+C
    WRITES ( Sum is ) WRITEN(SUM) $)
```

which adds three numbers together to produce their sum.

BCPL is blessed with a rich variety of conditional statements. *If Then*, *Unless Do*, *Test Then/Else* give powerful loop commands, and *For To By Do*, *While/Do*, *Until Do*, *Repeat*, *Repeatwhile* and *Repeatuntil* give exceptional repetitive commands.

An extreme redundancy which has been termed 'syntactic sugar' (!) BCPL also has, *inter alia*, a *Goto* command, though its use is discouraged — other commands are recommended as being normally superior.

In their book, Richards and Whitby Stevens stress the fundamental importance of indirection operators in BCPL. More of these next week.

Also, BCPL is very like Forth — for example both deal with patterns of bits, and what you make of the pattern is what you make of it (!). Next week I will also look at some of the similarities between the two languages. ■

Boris Allan

Puzzle

How many wotzits

Puzzle No 66

Harry is chief packer in the dispatch department of the Wotzit Manufacturing Company. On one particular occasion Harry was busy packing the week's production of wotzits. Since there has never been much demand for individual wotzits they are supplied in packs each containing a full set.

At the end of the day Harry noticed the curious fact that if he reversed the digits in the number of *packages* that he had, the result was equal to the total number of wotzits that were contained inside all the packages.

What was the smallest number of wotzits that would make this possible, and how many of them were in each package?

Note that any number which ends in a zero cannot be counted, as its reversal can't strictly speaking be said to contain the same digits (ie the reverse of say 20 is *not* 02).

Solution to Puzzle No 61

The program enters each number in turn into a string *N$* and this length is added to obtain a total *T*.

T is the number of half penny numerals, so when this total divided by two equals the current number, we have a solution.

```
10 LET N=1
20 LET T=0
30 LET T=T+(LEN(STR$(N))/2)  1
40 IF N=T THEN PRINT "Number of lockers = ";N
50 LET N=N+1
60 GOTO 30
```

Another approach is to use simple algebra. The solution is found when
No of numerals used × cost per numeral = total number of lockers.

For less than 10 lockers $x = \frac{x}{2}$ which has no solution.

For less than 100 lockers (but more than 9) $\frac{2x-9}{2} = x$ which also has no solution.

But for a number of lockers between 100 and 999

$$\frac{3x-90-18}{2} = \frac{3x-108}{2} = x,$$

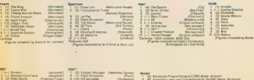
which does have a solution.

Using either the computer program or algebraic solution the answer is found to be 108 lockers.

Winner of Puzzle No 61

The winner is Andrew Turst, The Vale, London NW11, who receives £10.

Top 10



Dragon

1	(1)	The King	(Microdeal)
2	(2)	Space War	(Microdeal)
3	(3)	Talking Android Attack	(Microdeal)
4	(4)	Planet Invasion	(Microdeal)
5	(8)	Night Flight	(Salamander)
6	(10)	Dragon Trek	(Wintersoft)
7	(6)	Katerpiller Attack	(Microdeal)
7	(—)	Mined Out	(Quicksilva)
9	(—)	Graphics System	(Salamander)
10	(9)	Chess	(Dragon Data)*

*Cartridge
(Figures compiled by Boots & Co, London)

Spectrum

1	(1)	Penetrator	(Melbourne House)
2	(5)	Transylvanian Tower	(Richard Shepherd)
3	(2)	Jet Pac	(Ultimate)
4	(3)	Flight Simulation	(Psion)
5	(4)	The Hobbit	(Melbourne House)
6	(6)	3D Tanx	(D K Tronics)
7	(—)	Chess	(Psion)*
8	(6)	Starship Enterprise	(Silversoft)
9	(8)	Ah Diddums	(Imagine)
10	(—)	Pssst	(Ultimate)

*Requires 48K
(Figures compiled by W H Smith & Sons Ltd)

Atari

1	(4)	The Search	(CS)
2	(3)	Miner 2049er	(Big Five)*
3	(2)	Zaxxon	(Datasoft)
4	(—)	Rescue Chase	(First Star)
5	(—)	AE	(Broderbund)§
6	(—)	Airstrike	(English software)
7	(8)	Hellcat Ace	(Microprose)†
8	(—)	Zork 1	(Infocom)§
9	(—)	Chopper Rescue	(Microprose)†
10	(—)	Venus Voyager	(English software)

*Cartridge †32K cassette §48K disc
(Figures compiled by Calisto Computers, Birmingham 021 632 6458)

Vic20

1	(1)	Arcadia	(Imagine)
1	(—)	Catcha Snatcha	(Imagine)
3	(2)	Cosmiads	(Bug-Byte)
4	(3)	Wacky Waiters	(Imagine)
5	(6)	Race	(Commodore)
6	(4)	Panic	(Bug-Byte)
7	(5)	Asteroids	(Bug-Byte)
8	(7)	Amok	(Audiogenic)
8	(8)	Blitz	(Commodore)
10	(10)	Kaktus	(Audiogenic)

(Figures compiled by Boots & Co, London)

BBC*

1	(—)	Snooker	(Acornsoft)
2	(—)	Starship Command	(Acornsoft)
3	(3)	Killer Gorilla	(Program Power)
4	(—)	Moonraider	(Program Power)
5	(1)	Great Britain Limited	(Simon W Hessel)
6	(—)	Countdown to Doom	(Acornsoft)
7	(—)	Inheritance	(Simon W Hessel)
8	(10)	Castle of Riddles	(Acornsoft)
9	(*)	Chess	(Program Power)
10	(—)	Philosopher's Quest	(Acornsoft)

*Boots B only
(Figures compiled by Micro Management, Ipswich 0473 59181)

ZX81*

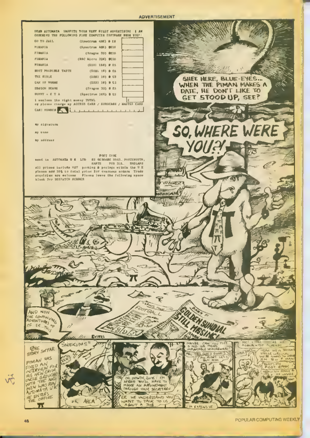
1	(2)	Football Manager	(Addictive Games)
2	(1)	Flight Simulation	(Psion)
3	(10)	QS Asteroids	(Quicksilva)
4	(8)	1K Chess	(Artic)†
5	(3)	Fantasy Games	(Psion)
6	(8)	1K Games	(Artic)†
7	(5)	Chess	(Psion)
8	(7)	Defender	(Quicksilva)
9	(4)	Space Raiders	(Psion)
10	(—)	Espionage Island	(Artic)

*All 16K except where shown
†Runs in 1K
(Figures compiled by Boots & Co, London)

Books

1	(3)	*Structured Programming with BBC Basic* Atherton	(Norwood)
2	(5)	*Assembly Language Programming for the BBC Micro* Birnbaum	(Macmillan)
3	(—)	*Programming the BBC Micro* Williams	(Newnes)
4	(4)	*Commodore 64 Programmers Reference Guide* Commodore	(Commodore)
5	(—)	*Mastering the Vic20* Jones	(Horwood)
6	(—)	*6800 Assembly Language Programming* Leventhal	(Osborne)
7	(1)	*Vic Programmers Reference Guide* Commodore	(Commodore)
8	(—)	*Compute's First Book of Vic* Compute	(Compute)
9	(—)	*Complete Spectrum Rom Disassembly* Logan	(Melbourne House)
10	(6)	*Forth on the BBC Microcomputer* De Grandis-Harrison	(Acornsoft)

(Figures compiled by Watford Technical Books, Watford 0923 23324)
(Last week's position in brackets)


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